Railway and Locomotive Engineering

A Practical Journal of Railway Motive Power and Rolling Stock

INDEX FOR VOLUME XVI, 1903.

Illustrated articles are marked with an asterisk, thus *

A

B

C

D

E

F

G

H

I

K

L

Railway and Locomotive Engineering

Copyright by Angus Sinclair Co.—1903

A Practical Journal of Railway Motive Power and Rolling Stock

Vol. XVI. 174 Broadway, New York, January, 1903 No. 1

LOCOMOTIVE ANNIVERSARY NUMBER

The Growth of the Locomotive.

BY ANGUS SINCLAIR.

The first locomotive engine designed to run upon rails was built in the year 1803, consequently this is the 100th anniversary of the introduction of the railway locomotive. The engine was designed by Richard Trevithick, a Cornish mine captain, and built under his direction in a blacksmith's shop connected with iron works at Merthyr-Ty'dvil in South Wales.

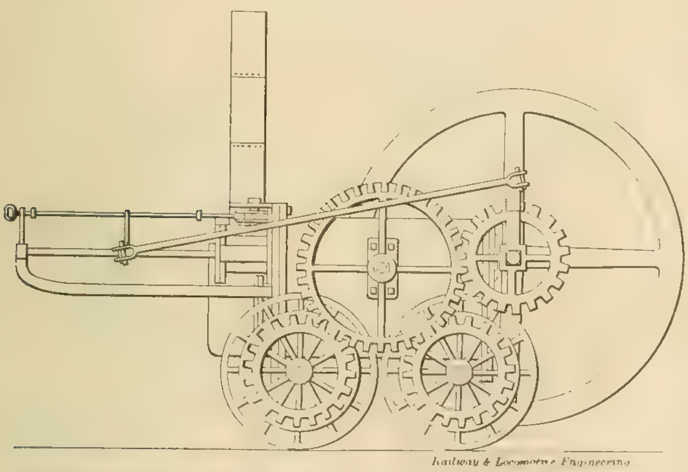
WHERE THE FIRST ROAD LOCOMOTIVE WAS BUILT.

If any student of industrial history possessed of the poetic instinct of looking into the origin of things should happen to be in the bustling city of Cardiff on the Bristol Channel, and wishes to see the place where the locomotive engine had its birth, a trip of 24 miles up a beautiful vale will lead him into the heart of lofty mountains, within whose recesses is built the thriving town of Merthyr-Ty'dvil, the principal seat of the iron trade of South Wales.

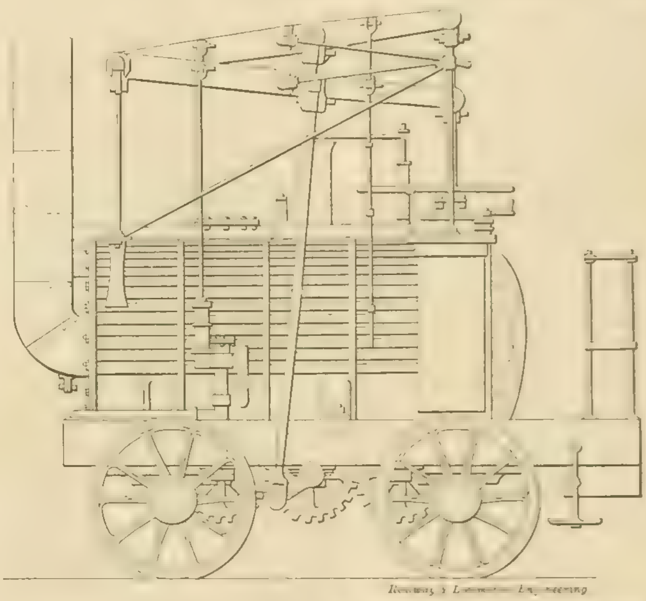
This is no town of mushroom growth. The district is rich in argillaceous carbonate of iron ore, which led to the introduction of smelting furnaces that were worked before the Norman Conquest of England. As Britain advanced in manufacturing arts iron became a prime necessity, and the iron furnaces of South Wales increased and prospered. The business resulting made Merthyr-Ty'dvil an important town at the beginning of last century.

AN IMPORTANT WAGER.

The residents of the district, many of them the descendants of mighty smiths, those valiant artisans who took the lead in developing manual dexterity, appear to have kept informed on the progress of engineering, for one of them, Samuel Homfray, made a wager of 1,000 guineas ($5,250) that he could convey a load of iron a distance of nine miles by the power of steam alone on a cast iron tramway.



TREVITHICK'S LOCOMOTIVE, 1803. FIRST LOCOMOTIVE BUILT TO RUN ON RAILS. FIG. 1.



HEDLEY'S "PUFFING BILLY" 1813. FIRST LOCOMOTIVE USED COMMERCIALLY IN HAULING CARS. FIG. 2.

RICHARD TREVITHICK.

Trevithick had been experimenting for several years with a steam carriage for common roads, and there is a working model of a locomotive made by him preserved in the patent department of the South Kensington Museum, London. His efforts to make a steam road carriage a success were widely known and he was invited to construct the engine that was to win Mr. Homfray's wager.

In 1802 Trevithick had been granted a patent for a high-pressure steam engine, which contemporary writers say was an imitation of engines built by Oliver Evans, of the United States, for years previous. Trevithick, however, devoted his attention to using the engine for land transportation, and he made, in 1803, an engine, Fig. 1, that in February of next year conveyed ten tons of iron nine miles, gaining the wager for his employer.

A PRACTICAL LOCOMOTIVE.

Although the engine is fearfully and wonderfully made with its complication of gearing, it was a practical locomotive and contained all the elements of the modern locomotive, except the multitubular boiler. This engine had a return flue boiler which was fairly efficient. As shown the engine was carried by two pairs of wheels, which were 52 in. diameter; the boiler was 60 in. long and contained a return flue. There was one cylinder 8 x 54 in. to transmit the power. After being used, the steam was passed into the smokestack, where it aided in creating draft upon the fire.

This engine made a few trips over the rough tramway at a speed of about five miles an hour; but it broke many of the cast-iron plates forming the rails and was withdrawn as a commercial failure.

Athough his first railroad locomotive was a commercial failure, it was mechanically as successful as anything that

followed it in the next 20 years, when the evolution of the steam locomotive was being worked out by the ablest mechanics in the world. So Trevithick is entitled to be called the father of the locomotive engine.

The developing of every complex machine has been a labor of years and the locomotive engine was no exception.

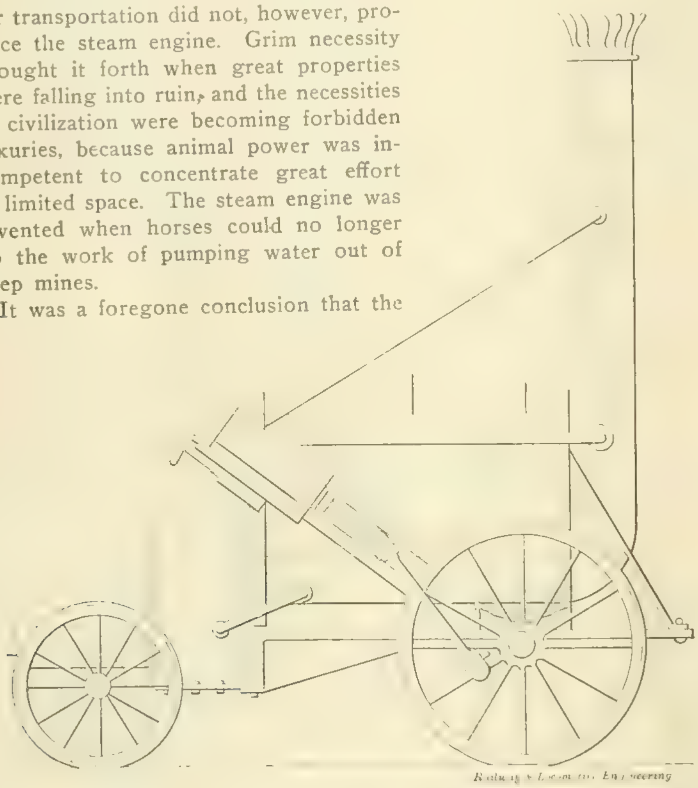
WHEN INVENTIONS ARE BORN.

In the history of the world we see that needed inventions come forth when "nature must obey necessity." When the idea of applying the potential power of heat to lighten the drudgery of mankind was conceived, the hope of its most useful field was in carrying heavy burdens and in bringing distant places into closer connection. The need of artificial power for transportation did not, however, produce the steam engine. Grim necessity brought it forth when great properties were falling into ruin, and the necessities of civilization were becoming forbidden luxuries, because animal power was incompetent to concentrate great effort in limited space. The steam engine was invented when horses could no longer do the work of pumping water out of deep mines.

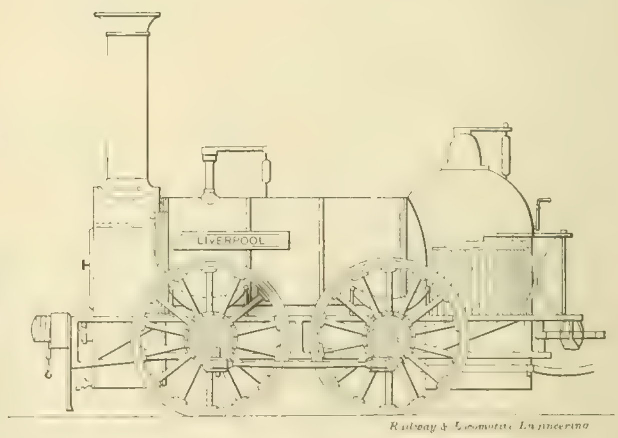
It was a foregone conclusion that the steam engine would be applied to transportation purposes as soon as the needs of mankind exceeded the easy capacity of the horse.

SLOW PROCESS OF DEVELOPMENT.

After a practical steam engine was invented it took half a century to develop it into a motor suitable for driving manufacturing machinery. Another half century passed before inventors began seriously attempting to devise a steam engine to drive a vehicle on land. A variety of experimental locomotives had been built or patented before the 18th century closed, but nothing of a promising nature was produced until Trevithick's engine was built. Although Trevithick abandoned the practice of locomotive building after his first real attempt, the influence of his work was far reaching. The fame of his achievement had gone forth and reached the ears of men who were staring at the specter of ruin in the expense of horse power for hauling heavy loads.



STEPHENSON'S ROCKET, FIRST HIGH-SPEED LOCOMOTIVE.



BURY'S LOCOMOTIVE, 1834. BECAME THE PROTOTYPE OF THE AMERICAN LOCOMOTIVE.

HEDLEY'S PUFFING BILLY.

For the next 10 years after Trevithick's experiment there was considerable effort made to produce an engine that would work satisfactorily. Much attention was devoted to devising means to prevent the slipping of driving wheels, which was a serious trouble with Trevithick's engine due to the tractive power being much too great for the weight available for adhesion. A variety of engines were built and tried, but the first engine made to run on rails, and which did the work of hauling cars regularly, was built by William Hedley, chief engineer of Wylam colliery on the River Tyne, near Newcastle, England. His first engine was not a success, but his experience with its shortcomings enabled Hedley to build a second engine, which worked fairly well and is now to be seen in the South Kensington Museum, London, bearing the name of "Puffing Billy."

This engine, which was built in 1813, had a return flue boiler, which provided all the steam required. This form of boiler had been used by Trevithick and Hedley made it a practical success. It was the best form of boiler used until Robert Stephenson applied the multitubular boiler to the "Rocket" in 1829.

BEGINNING OF THE GRASSHOPPER TYPE.

The "Puffing Billy" was the beginning of a sort of grasshopper type of engine, which, under a variety of modifications, became the fashion and held the field up to 1829, when the directors of the Liverpool & Manchester Railway offered a prize for the most successful locomotive and a variety of novel types were produced. Hedley's engine was not a model of simplicity, but its complications were modest compared to many of its successors. The pioneer locomotive builders did not realize that complicated mechanism was objectionable until sad experience with breakdowns taught them that the fewer parts used which were liable to breakage the more successful the engine was likely to be. They were the engineers who first learned about the extra destructive effects that result from the engine jolting over a rough track.

PUFFING BILLY IN SOUTH KENSINGTON MUSEUM.

During a visit to South Kensington Museum, London, the writer wrote:

"To me one of the most interesting relics in the great collection at South Kensington Museum is Hedley's 'Puffing Billy,' built in 1813, and which was the first successful locomotive ever put to work on a railroad track. It was after an examination of this engine that George Stephenson proceeded to build a locomotive of similar style, but which was not such a good working engine as the 'Puffing Billy.'

The 'Puffing Billy' has a furnace extending about half way into the boiler and a flue leading to an up-take, from which the gases of combustion passed through a return flue to the smokestack. The fireman did his work at the smokestack end of the boiler and the engineer sat in front on a wooden seat held by four upright iron posts. The frames are of wood, quite substantial in form and rest upon the axles without the intervention of springs. The four wheels are connected by inside gearing, and the motion is transmitted to a gear wheel upon a separate axle. The tank is an oblong iron box, set behind the coal

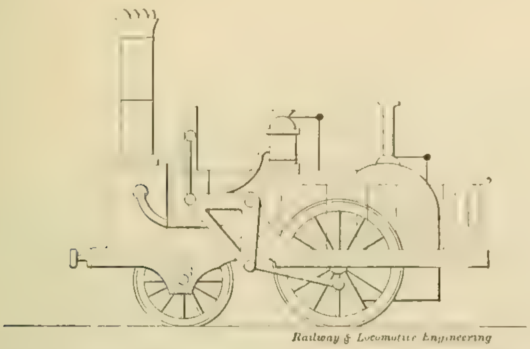
bunker, the water being carried to the pump by an iron pipe with a flexible leather connection. The engine and tender are coupled together by means of a chain similar to what is still employed in connecting wagons together on English railways.

The cylinders are made of wrought iron in two sections, riveted together. The steam chest is a small cavity towards the top of the cylinders, and there is a handle for connecting the valve stem that catches on a vertical plug rod connected with the walking beam.

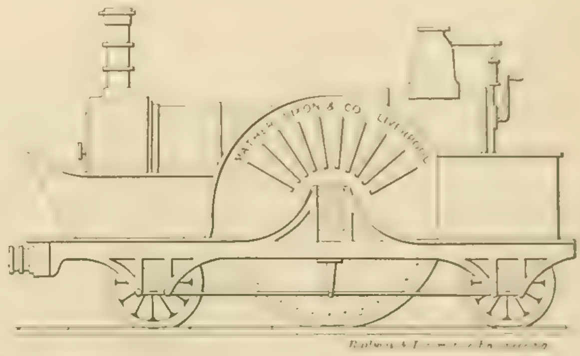
The engine shows evidence of very substantial workmanship, although no attempt at finish appears to have been made. The boiler is lagged with wood, held in place very much as is the lagging of modern locomotives.

The cylinders are 9 x 36 inches, grate area 6 feet, heating surface 77 square feet. The valve is of the D slide form, worked by a shaft motion. The engine rests upon fish belly rails.

Two vertical cylinders are used, which, by grass-hopper beams, transmit the motion downwards by vertical connecting rods to a shaft with overhanging cranks set at right angles. This shaft carries a spur wheel, which, with four other spur wheels, transmits the motion to the two driving wheels, each 39 inches in diameter."



ROBERTS' EXPERIMENT. ONE OF THE FIRST FREAKS. FIRST LOCOMOTIVE WITH PISTON VALVES WHICH WERE A FAILURE.


EARLY GREAT WESTERN LOCOMOTIVE WITH DRIVING WHEELS TEN FEET DIAMETER AND WIND SPLITTING FRONT END. FAILURE ALSO

STEPHENSON'S FIRST LOCOMOTIVE.

At the time Hedley's locomotives were built, George Stephenson, an ambitious mine foreman, was employed at a neighboring colliery. In 1814 he built an engine something like Hedley's, but with a single flue, and it was next to a failure, but Stephenson was wonderfully persistent and was encouraged to try and try again, until within 20 years, in company with his son Robert, he become the principal locomotive builder in the world.

DISCOURAGING PERIOD OF EXPERIMENT.

The years from 1803 until 1830 were a period of experiment in developing the locomotive. The history of the locomotive from the time of Trevithick's experiment until the Stephensons achieved their triumphs with the "Rocket" in 1829 presents a record of disasters, failures and of men's perseverance while within the grasp of distressing discouragements, and forcibly illustrates the determined persistence which some men will devote to the practical working out of an idea.

The locomotive engine was developed into a practical motor by hauling coal on private railways connected with coal mines in the north of England. In 1825 the Stockton & Darlington Railway, a public enterprise, 25 miles long, was opened and operated by locomotives built by the Stephensons and others. George Stephenson & Son had established locomotive building works at Newcastle, and many other firms were by this time turning their attention to making locomotives.

THE LIVERPOOL & MANCHESTER RAILWAY.

The ancient city of Manchester, the headquarters of the Lancashire textile industries, had long been famous for the enterprise and public spirit of its citizens. This important mart of manufacturing was distant about 30 miles from Liverpool, the nearest seaport, and Manchester's trade languished through the delays and difficulties encountered in transporting goods to and from the port of shipment. Sometimes it took longer to transport a cargo of cotton from Liverpool to Manchester than it did to bring it across the Atlantic in a sailing ship. About the time the Stockton & Darlington Railway was opened a few leading merchants of Liverpool and Manchester organized a company to construct a railway from Liverpool to Manchester. Permission to build the line had to be obtained from Parliament and stupendous opposition was offered. After a long and vigorous fight the promoters of the enterprise were successful and the railway was constructed.

DOUBT ABOUT WHAT POWER TO ADOPT.

Although there were about 50 locomotive engines at work in different parts of England when the Liverpool & Manchester Railway was approaching completion in 1828, there was great conflict of opinion about what form of power was most suitable for operating it. The learned consulting civil engineers favored the use of stationary engines with rope traction, George Stephenson, who had been engineer of construction, with other practical men, advocated the use of locomotives. After several months of indecision the directors of the company determined to try locomotives and offered a prize of £500 ($2,500) for an engine that would fulfil certain requirements.

RAINHILL COMPETITION TESTS.

Three engines were entered to contest for the prize, all of them decided departures from the prevailing grasshopper types. The "Rocket," built under the supervision of Robert Stephenson, won the prize. A series of very thorough tests was made at Rainhill, near Liverpool, and the "Rocket" was the only engine that went through the trials without some kind of mishap. In a short test of speed without any load the engine attained a speed of 29 1-2 miles an hour, and with a car containing 36 passengers it made 28 miles an hour.

This extraordinary speed was a startling revelation to the people who had opposed the practicability of locomotives, and did more than all the previous 26 years' experience with locomotives to convince people that a new era in methods of land transport had arrived.

FROM COMPLEXITY TO SIMPLICITY.

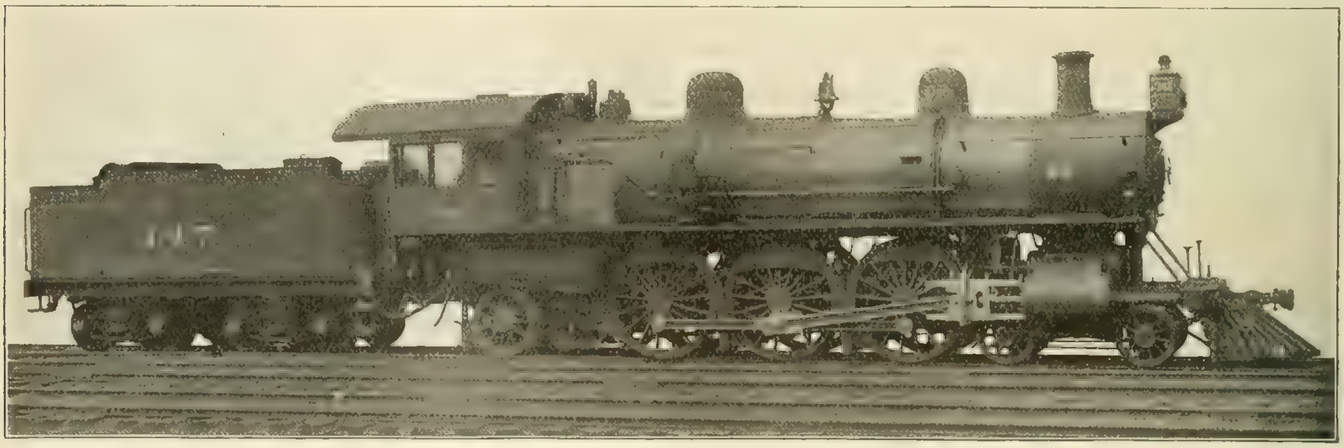
When an engineer examines the "Rocket" and compares it with those previously in use, he seldom fails to observe that a leap had been made from complexity to simplicity of design. The absence of superfluous parts to get out of order doubtless contributed in no small measure to the success achieved in the trials.

The "Rocket" possessed all the elements of the modern locomotives, and the work left for succeeding designers to perform was merely that of enlargement of parts and adjustment of increased proportions or to the modifying of forms to suit individual tastes. The three most important features of the engine were a

multi-tubular boiler, forced draft by the exhaust steam and direct connection between the piston rod and the crank pin secured to the driving wheel. None of these features was original. Trevithick and others had employed the exhaust steam to create draft in the chimney; the multi-tubular boiler had been previously used in the United States and in France, and direct piston and crank-pin connection had been made on several locomotives. It was the combination of three highly meritorious features that made the engine the pioneer of a new type.

"ROCKET" MODEL TO PATTERN FROM.

Most of the locomotive builders in Great Britain readily recognized the merits of the very simple engine produced by the Stephenson's, and they proceeded to develop their engines on similar lines; but for a few years after the "Rocket" appeared there were a superabundant variety of freak locomotives



MOST POWERFUL PASSENGER ENGINE EVER BUILT CYLINDERS, 22x28 INCHES; DRIVING WHEELS, 72 INCHES DIAMETER HEATING SURFACE OF BOILER 3,533 SQUARE FEET. TRACTIVE POWER 32,000 POUNDS.

produced, that testified more to the ingenuity than to the good sense of the inventors.

LINES OF DEVELOPMENT.

The "Rocket" was a four-wheel engine, the front pair being the drivers, to which power was transmitted from outside cylinders set diagonally across the boiler pointing toward the back head. The first improvement made on the next engine was to drop the cylinders to a nearly horizontal position at the sides of the firebox. That was followed by placing the driving wheels behind and locating the cylinders in the smoke box, from whence the power was transmitted to the driving wheels through a cranked axle. Outside frames were employed for the first time. The first of this style of engine was built by the Stephensons and was called the "Planet," and led to what was known as the planet type. Many engines of this kind were imported into the United States and had some influence on the designs of early native-made locomotives. One of the most famous of these was the "John Bull," imported by the Camden & Amboy Railroad, now a part of the Pennsylvania Railroad.

BURY'S ENGINE.

The Stephensons were not, however, the originators of the cranked axle engine with cylinders in the smoke box. That style was designed in 1829 by Edward Bury, although it was not finished until 1834. This engine, or others of a similar pattern, exercised a great influence on American designs. The Bury engine had inside cylinders, inside bar frames and a boiler with hemispherical or "haystack" topped firebox, as our people called it. Our readers will readily identify the Bury engine as the prototype of many early American locomotives.

INCREASING THE SIZES.

The line of locomotive development followed in Great Britain was, first, the single pair of drivers and pair of carrying wheels; then two pairs of wheels coupled; then two pairs of coupled wheels and a pair of carrying wheels. Later for freight service three pairs of wheels coupled and for passenger trains a single pair of drivers in the middle and carrying, in the front and back. There was considerable diversity of practice in location of cylinders, some designers putting them inside and others outside. Outside frames were for years the favorite style of construction, but that was gradually changed to inside slab frames and an outside supplementary frame. The engine truck, or bogie, as they call it, was gradually adopted within the last 20 years, and the prevailing passenger engine in Great Britain now has four wheels connected and a four-wheel leading truck. For a long time they adhered to plain six-wheel connected engines for freight service, but an eight-wheel connected engine for that purpose is now growing into favor. Inside cylinders are almost universally used. Compound locomotives have been introduced upon a few railways in Great Britain, but they obtain very little favor.

Continental countries imitated the British style of locomotive for many years, with the exception that outside cylinders were preferred. In minor details nearly every country adopted forms that gave the engines national characteristics.

GROWTH OF LOCOMOTIVE BUILDING IN THE UNITED STATES.

The agitation in favor of railroad building began in the United States about the same time as it began in Great Britain, and the machinery for operating them was developed largely by native engineers. Thanks to ignorant writers for encyclopedias and to writers of romancing biography, there is an impression prevailing that pioneer American railroad engineers were guided entirely by English types of machinery and English methods of construction, which is a fallacy. Those who have studied the subject thoroughly believe that railroads and locomotive building in America would not have been much delayed had Watt never worked on improving the steam engine, and had George Stephenson never been born. Oliver Evans, a native of Delaware, developed the high-pressure, high-speed engine as an improvement on Newcomen's atmospheric engine, and it was much better adapted for locomotive purposes than the ponderous slow-moving engines that early British inventors had to work after while designing locomotives.

Woods, an early writer on railroads, who was a contemporary of Trevithick, positively asserts that the latter patented the high pressure steam engine after examining drawings of a high pressure steam engine which Oliver Evans had sent to Great Britain in hopes of interesting capitalists in his invention.

GENERAL IGNORANCE ABOUT RAILWAYS AND LOCOMOTIVES.

Americans, as a rule, knew very little about what Englishmen had done when

they began building railroads, and their first locomotives were purely original. Very little accurate information had reached America concerning what had been done in England before our people entered earnestly into the building of railroads. Before the railroad era there was scarcely any means of spreading scientific information, and few Englishmen knew anything about how railways were going to be operated when the Liverpool & Manchester Railway was under construction. Six months before the railway was ready for opening the directors were inundated with schemes for operating the road. There were plans proposed for working the cars by water power. Some proposed hydrogen, others carbonic acid gas. Atmospheric pressure had its advocates, others favored greased cog rails. There was a multitude of counselors who proved nothing except that even the scientific men of England had no knowledge of what had been done by Trevithick, by Hedley, Stephenson, Hackworth and others.

AMERICANS PROCEED TO BUILD RAILROADS.

That being the condition of engineering knowledge in Great Britain, it was not surprising that Americans had to fall back upon their own resources when they proceeded to build railroads and to put them into operation. The nation has always been celebrated for self-reliance, and the pioneer railroad builders pushed along without hesitation, crossing the bridges of difficulty when they were reached. So far were they guiltless of imitating English methods that they built and began operating the first railroad in the world ever projected for general traffic and worked it with motive power of native design. That was the Baltimore & Ohio Railroad, which was chartered in 1827 and part opened for business in 1830.

This article is too long to be completed in one number, so the greater part must be held over, when our readers will be able to read a brief history of what American engineers and inventors have done for the locomotive. Meantime, we finish with two illustrations of what we regard to be the highest development of the locomotive as an engine for earning revenue.

The Chesapeake & Ohio ten-wheel passenger engine, built by the American Locomotive Company, has a 32,000 pounds tractive power, and has a boiler with sufficient heating capacity to keep up steam when cutting off at half stroke.

The Southern Pacific compound consolidation engine, built by the Baldwin Locomotive Works, has 41,000 pounds tractive power, and is capable of hauling about 1,500 tons up a grade of 50 feet to the mile.

(To be continued.)

IDEAL FREIGHT ENGINE BUILT BY BALDWIN LOCOMOTIVE WORKS. CYLINDERS, 17 AND 28 x 30 INCHES; DRIVERS, 57 INCHES DIAMETER; WEIGHT, 204,800 POUNDS; HEATING SURFACE, 3,600 SQUARE FEET; TRACTIVE POWER, 40,000 POUNDS. CAN HAUL 1,500 TONS UP GRADE, 50 FEET TO THE MILE.

100 Ton Niles Crane at the New L. S. & M. S. Shops.

The 100-ton, 5-motor electric traveling crane which has recently been installed by the Niles-Bement-Pond Company at the Collinwood shops of the Lake Shore & Michigan Southern Railway, is of particular interest to mechanical men. In the illustration on page 8, this crane is shown in the act of lifting an 80-ton consolidation type locomotive. The crane is of the Niles standard design, fitted with two 50-ton trolleys. The main hoist motors are each of 45 horse power and are capable of hoisting the full load at a speed of about 10 ft. per minute. The bridge motors traverse the bridge up or down the shop, which is about 530 ft. long, at the rate of 150 ft. per minute with the full load and 200 ft. per minute, light. The bridge is a Niles standard box girder. It is fitted with eight truck wheels running in heavy steel truck frames, which are securely riveted to the box girders, and it has a span of 65 ft. 6 in. All gears on this crane are cut from the solid and run submerged in oil. Each trolley is equipped with the Niles improved automatic safety mechanical brake, which controls the load at all times, and also an electric brake mounted on the armature shaft which is "on" when the current is thrown off. The motors are designed especially for crane work and are wound for 220 volts, direct current. Each motor has its reversible controller and rheostat. This shop is an excellent example of the best modern practice in locomotive shop design and equipment.

Making Electricity Out of Nothing.

When writers in ordinary newspapers make mistakes concerning the laws of nature in describing inventions, the technical press seldom fail to cast redicule on the writers. The technical press, therefore, ought to be very careful not to fall into similar mistakes. The following article from the New York *Times* reads a sensible lesson on this matter:

Our learned friends on the professional and industrial press never weary of saying derisive things about what they call "newspaper science," and it must be confessed that they do not lack for frequent opportunities to prove as well as to assert that "newspaper science" is fearfully and wonderfully made. Realizing this fact, we have been accustomed to accept with as close a simulation of humility as we could conveniently assume the high and mighty criticisms of our specializing mentors. But we have not been quite as happy under discipline as we have looked, and it is with sincere joy that we note the appearance in *Electricity* of some "science" as well calculated to astonish as any story about a perpetual motion machine or a frog living for years in a human stomach that ever appeared in the most credulous of daily papers. The article that gives us this joy concerns the lighting of railway trains by means of a windmill-like device fastened in front of the boiler-head of the locomotive. When the train moves, of course the windmill turns, and the power thus obtained charges a storage battery and continuous illumination

is secured. There is nothing incredible in all that, but imagine the feelings of a "newspaper scientist" when he reads: "No air pressure is massed on the flat surface of the boiler head, but the curved surfaces of the fan blades utilize the traveling air and thereby generate power. The fan cutting through the air revolves swiftly and does not add to the resistance of the air nor retard the speed of the train. No gale of wind is required to cause the fan to operate; the ordinary pressure of the train moves it sufficiently to generate the electrical energy required to light any train and leave a large surplus for ventilating fans and other purposes." Ho, ho! doesn't "retard the speed of the train," hey? Just "utilizes the traveling air, and thereby generates power"—out of nothing, or, what amounts to the same thing, out of traveling air that doesn't travel! But we foresee the hole out of which *Electricity* will make its escape—it will declare that what it meant to say was that the train lights are run with power that otherwise would be wasted, and it will hope that before the problem involved in that statement is solved the whole matter will be forgotten. We have resorted to worse expedients than that ourselves, on particularly trying occasions, and we'll do our best not to laugh at it.

Three Stories of Railroads.

Owing to a fight between the Burlington & Northwestern Railroad systems for the tremendous freight business of the great Homestake mines, Lead, S. D., has a tier of railroads, the like of which cannot be seen anywhere else in the world.

Standing on the surface track is a train on the Burlington line, while immediately above is an Elkhorn line train. Across the sky, high above all, looms the lofty trestle of the Homestake Mining Company, connecting its old and new shafts, mills and crushers across the gulch. A train of ore cars, pulled by a small steam locomotive, is in view, and beyond it one of the compressed air engines which the Homestake uses, can be seen.

The Elkhorn, a part of the great Northwestern system, entered Lead over the tracks of the Fort Pierre and Black Hills Railroad, a little narrow gauge line, which connected with the Elkhorn main line at Buffalo Gap, while the Burlington came in over its own tracks. The latter road one day stole a march on its competitor and bought the Fort Pierre road, shutting the Elkhorn out of the city.

It was thought impossible to build another line into Lead, since the only two gulches through which a train could pass were owned by the Burlington.

THREE STORIES OF RAILROADS.

But a corps of Northwestern surveyors were put to work and the result of their labors was that the Elkhorn constructed a line from Deadwood, which sweeps around in majestic curves and easy grades until it is right on top of the mountain and passes through a cut, the sides of which are worth hundreds of dollars per car load, in fact passes right through part of the great Homestake mine.

We are indebted to the New York *Herald* for above cut and description.

Humors of Booking Strange Animals.

On European railways there are a great many small packages sent as parcels. There is a schedule of charges for various kinds of goods and it is amusing to witness the embarrassment of the booking clerk when any article is offered not mentioned in the schedule. An English parcels clerk was once offered for transportation a crate containing a turtle. He pondered over the case and remarked: "It is some kind of a big hinsect, but it is not a crab, or a lobster. It is not a fish, and it is not a cat, but I shall book it as a heel," and as an eel it went.

A humorous chapter might be written on the following adventures of a monkey, recounted in a paragraph, entitled, "What Cannot an Ape Become?" published in the German *Journal of Sport*. A German returning from German East Africa brought with him as a pet a small monkey, weighing about one pound. From Tanga to Genoa no charge was made. From Genoa to the Swiss frontier the railway authorities described the little creature as a "bird," and charged 1 1-2 lire for his fare. When he reached Switzerland the Gothard Railway officials were persuaded that he was not a "bird," but a "dog." Accordingly, a dog ticket, costing 8 1-2 francs, had to be taken for him. The next railway company in Switzerland, not being certain under what category of animals he should be classed, dismissed him as "passenger's luggage," taking only a fee of about 7 pence for him. In Baden and Würtemburg, as far as Stuttgart, the monkey passed as "hand luggage," and was permitted to travel as such scot-free; but from Stuttgart to his destination he was again relegated to the canine species, and as a "dog" a ticket was demanded for him, value 1s. 7d.

New Lehigh Valley Dining Cars.

The Lehigh Valley Railroad is to place in service two new dining cars to supplement its present excellent dining car system. The two cars will be exactly alike, and no care or expense has been spared in their construction. The ends will be fitted with wide vestibules, and on each side will be four oval opalescent windows and nine large double windows, mahogany sash. The windows in the side roof are opalescent glass in metallic frames. The interior of the cars will be finished in Cuban mahogany, with finely figured veneer panels. The ceiling, full Empire, will be decorated in gold leaf. Window curtains are to be rose pattern, green silk-faced pantasote, with acme fixtures; dining chairs, mahogany, seats and backs upholstered in leather. The dining room in the car will seat 30 people. A pleasing feature in summer time will be the cooling of the cars by electric fans, three of which will be placed in each car.

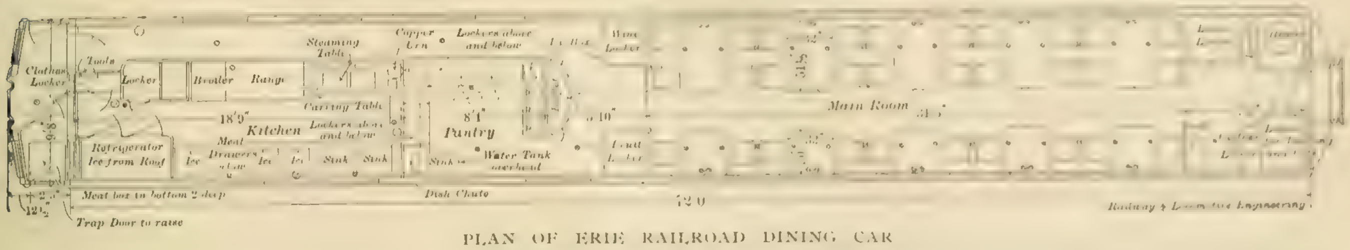
To obtain the maximum opening of any circular valve it is necessary to raise the valve off its seat a distance equal to one-quarter of its diameter. A valve five inches in diameter, for example, has 19.635 square inches area, and when raised 1¼ inches gives full opening. If lifted higher than this, no greater opening is obtained.

Erie's Handsome Dining Cars.

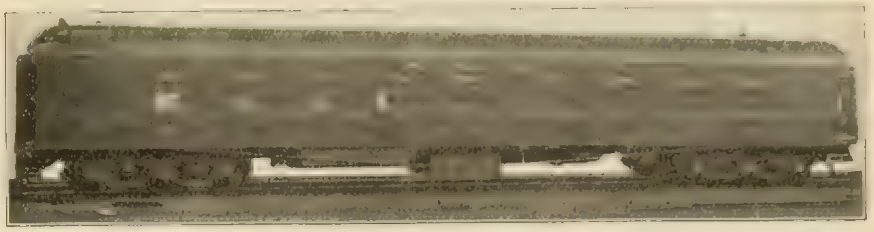
The Passenger Department of the Erie Railroad has just placed in commission between New York and Chicago a new dining car which for perfection of appointment in every detail, is probably without a superior on any railroad in the world.

The interior trimming throughout is hand polished mahogany, beautifully inlaid with white box. There is an entire absence of the ordinary carving, but at intervals in the walls are niches for potted plants, and the general effect, heightened by the generous use of harmoniously tinted cathedral glass, is rich in the extreme. The furniture corresponds, of course; the napery is all of the very best Irish linen, made to order; the service of heavily plated silver; every article bearing the well-known insignia of the Erie. The car is brilliantly lighted by electricity, with gas as a reserve. It has an electric fan at each end, and is, in every respect, as comfortable to ride in as a car can be made. The solidity with which all the parts appear to be fairly welded together, makes the running exceptionally free from vibration.

The kitchen, pantry, dry-air closets, refrigerators, wine-locker, etc., are constructed after the latest and most improved ideas, and the combination of economy of space with convenience and comfort of operation is simply wonderful. So perfect are the arrangements that it would almost seem that a dinner could "get itself," but nothing is left to chance, and it goes without saying that car 956 carries a chef whose ability corresponds with his surroundings.



PLAN OF ERIE RAILROAD DINING CAR



ELECTRIC LIGHTED DINER ON THE ERIE.

The Cuban Railroad.

Sir William Van Horne's Cuban Railway is a very sound enterprise commercially, but it probably would not have been built had it not appealed to the imagination of this hard-headed railway chief, who is also an artist, a literary critic and something of a fairy godfather. To take hold of the war-racked and desolated island and afford it the first requisite of civilization was decidedly Van Hornesque. He has that rare combination, imagination and the highest executive talent. The Cuban Railway will afford him as much satisfaction as a *Teniers* or a piece of rare Japanese porcelain, and it will make the island a safe country for every one. Sir William will be 60 years of age in February, young enough to build a few more railways.—*Toronto Globe.*

To Prevent Collisions.

The devices so often patented in the United States for automatically stopping trains without the aid of the engineer have evidently found imitators in Germany. The following cable dispatch to the New York *Sun* explains itself:

A device for preventing collisions between railway trains was successfully tried on a railroad near Frankfort today. It consists of a small apparatus fitted to a locomotive which will give visible and audible signals if another locomotive is approaching on the same track or if a switch is misplaced. It renders it possible to have an understanding by telephone between locomotives. In to-day's tests two locomotives approached each other. When they reached a certain distance of each other the apparatus gave the signals and the engineers were able to communicate.

Dixon's "Graphite" for December contains an interesting article on experiments made by Professor W. F. M. Goss of Purdue University in the use of Dixon's graphite for air-brake equipment. The experiments were made upon the fifty-car train equipment at the University, and covered the use of vaseline without graphite, graphite without vaseline, and finally the use of graphite and vaseline. The experiments are not only interesting but of value to all who are connected or interested in locomotive engineering.

How the New Superintendent Introduced Himself.

BY SHANDY MAGUIRE.

The bulletin boards of the B. & R. division of the C., U. & B. had the following notice on them recently:

"Mr. C. H. Mayberry has been appointed superintendent of the B. & R. division, vice J. H. Arden, resigned."

A. B. DOWLING, Gen'l Supt.

"Merely that, and nothing more," but what a red hot shot it proved! How the stove committee got down to business! The all-absorbing question was, "Who is Mayberry?"

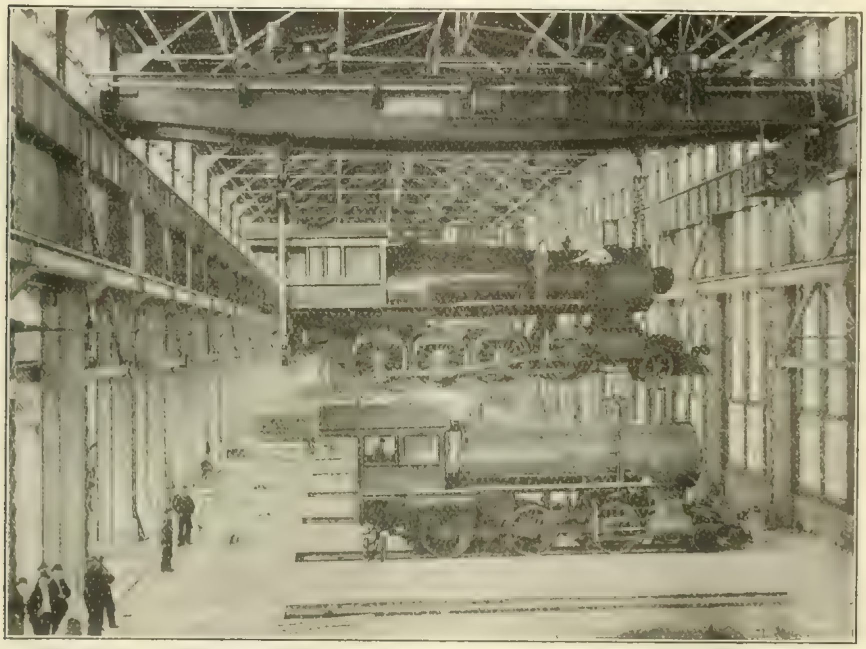
Pugnose Casey said he heard of a chap of that name whom the boys chased off the Raleigh between two days. Toejamb Curtiss said he was a cousin to the wife of the president. Crosseyed Crowley said he was a chap whose mother used to supply the general freight agent with milk, butter and eggs. No one had ever seen him to know him, and the committee adjourned to await developments.

Mr. Mayberry remained in his office for several days familiarizing himself with business and looking over old records.

One day, as train 80 was pulling out, a man about 40 years of age, with a clean shaven face, somewhat pale, and a pair of clear, intelligent eyes, dressed in an unpretentious suit of gray clothes, got on the off side from the station onto the baggage car platform and entered. The conductor was putting the finishing touches to a blond mustache and his necktie, taking special care to not let any part of it obscure the big diamond stud in his shirt front. In fact, he was grooming himself to the very best advantage, preparatory to going out to work the train. The train stopped, as the rules required, before crossing the tracks of the B. & R., then went ahead again. The baggage man was deep in the morning paper, with his two feet tipped up on the top of a trunk. The conductor passed from the mirror, navigating dexterously through the scattered trunks, till he got to the stranger. He was handed a pass, which read: "Pass one between Darien and Clive," signed by the new superintendent.

"You seem to have some travel on this road," said he to the baggage man, after the conductor left the car.

"Y-a-a-s," said the trunk-butcher with a devil-may-care-damn-your-soul sort of a drawl, without even lifting his eyes from the paper.



NILES-BEMENT-POND CRANE IN COLLINWOOD SHOPS OF L. S. & M. S. RAILWAY.
(Description on page 5).

"It is transient or permanent?"

"I dunno," came out curtly and sneeringly. Just then the train stopped and the station agent knocked at the car door. Lord Paramount opened it with a "What de ye want?"

"Here's a check for this gentleman's trunk."

He searched the checks of several trunks before he found the right one.

"See if you have any mail for me," said the agent.

A package of letters in a pigeon hole was searched, and one handed out. The train must have been detained at least three minutes before starting again. The gent in the gray clothes strolled out to the smoker and sat down in the next seat to a dandified-looking dude in uniform, with "brakeman" on his cap. He was reading the morning paper also.

"Please tell me how far it is to Greenville?"

"Two stations ahead," said the duke.

"Thanks," said the stranger. He then passed into the coach. The conductor was deeply occupied in keeping a young lady smiling, sitting close up to her in the same seat. He didn't wish to disturb him, so at the next stop he got onto the engine and showed a pass to the engineer, signed by the new superintendent.

"All right," said he, "you can ride." "Say, Jakey," said he to the fireman, "here is a pass from the new super., the first I've seen."

"Let me see it," said Jakey. "He isn't much of a writer, is he?"

"Naw, nor he doesn't know nauthen about railroadin'."

"How de ye know?"

"October-eyed Patsey Puddinhead said so. He heard of him from Snook Brown." The stranger was standing in the gangway taking it all in, also the deck with 6 inches of coal on it, and the filthy condition of the cab all around. The fireman would jump down from his perch, fling in about five shovelfuls of coal and fly up again and help his pard to watch the top of the stack, out of which was belching a dense mass of black smoke which mustered a big broad smile on both of their grimy faces, and this encomium from his royal highness: "Jakey, old boy, ye hit her that time right where she wanted it." The next stop was a meet. The local was on the siding. The stranger left the passenger train and got onto the caboose of the local, showing a pass to the conductor requesting the stranger to be let ride.

"All right, sir," said the conductor after reading the pass, "that's as good as the wheat. Make yerself at home. We are very busy on this train and seldom are troubled with passengers." The train was swinging along gaily. A brakeman was sitting in the lookout, with his eye on business, and the conductor examining bills.

"A flag is out at Ashland, Dan," said the lookout.

"That's too damned bad," said Dan, "and we havin' so much to do all the way in. Some 10-cent passenger wants to go to Lisbon and make us stop again. Make a signal to Tom to keep her movin' and I'll get off and make the passenger hustle." The train slowed down to about a 4-mile-an-hour gait as the caboose was passing the station, where an old woman stood, waiting to get on. Dan shouted out "Hurry up here, ould woman, give me hoult of yer leg."

He caught her and landed her on the steps, swung the engineer ahead again, and as he landed his passenger breathless in the car he said to her: "Why didn't you wait for the express and not stop us?"

"I got word that my daughter's little girl wasn't likely to live till night with the croup, and I couldn't sit nor stand

till I'd get to her to see her. I wasn't able to walk the 7 miles, so I thought I'd ride with you to Oakville and walk back the two miles."

"Ye won't have to walk back, Mrs. Arthur, I'll stop and let you off at the house if I was to be discharged for it. We all know little sunny-haired Ella. She wags her hand at us every day as we pass."

"May God bless you and never let your heart experience the grief of mine this winter," said the old lady.

The train slowed up again—the brakeman having notified the engineer—and Dan helped the old lady off, with a "Cheer up, Mrs. Arthur, ye'll find Ella all right, I'll bet."

The stranger was an interested observer. The train arrived at Easton in a little while. There was considerable freight to load and unload. The crew were hustling at it and the stranger strolled up to the engine. He found a clean cab, the fireman keeping a lookout for any signal which might be made, and the engineer looking around the engine.

"A local freight is a hard train to run," said the stranger to the engineer.

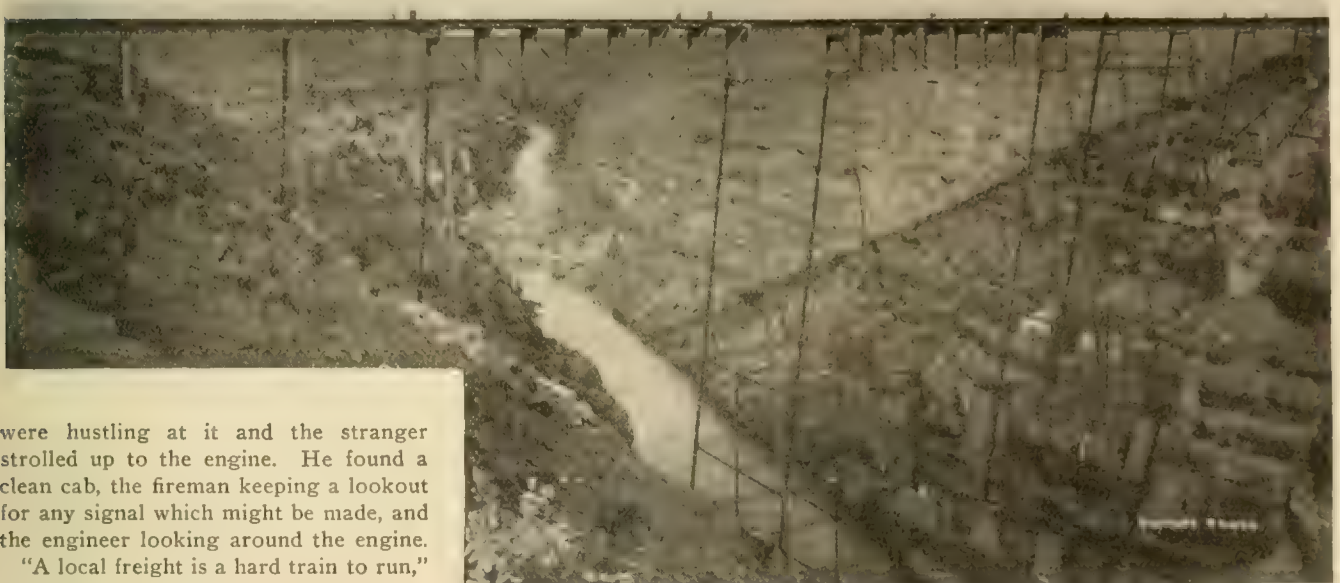
"Yes, sir, it is, but if men only work together they reduce the labor by dividing it. Either my fireman or myself always keeps a lookout behind, so as not to keep the crew waiting to get the signal to the engine; and when freight is very heavy, on an understood sign from the conductor, we go back and bear a hand. He is a tiptop man to run with, we have not much trouble in making time."

The stranger handed his card to the engineer and shook his hand as a passenger train dashed into the station, which he boarded. The card read: "C. H. Mayberry, Superintendent."

When Dan Dailey heard of it he hung his head and thought of stopping his train without orders.

"Me name is Dinnis, instead of Dan," was the way he told it to his men. A few days afterward any one could notice a decided improvement in the service, after the affair got circulated. The conductor, baggageman, brakeman, engineer and fireman of train 80 were summoned to the office of the superintendent in about 10 days after the above occurrence.

"Mr. Fletcher," said he to the conductor, "I hold you personally responsible for the lax manner your associates and yourself do business. Your baggageman is not fit for his place, neither are your trainmen. You never looked out to see if you had the right signal to cross the B. & R. No station order method is employed in baggage or mail in your car, and your trainmen are impudent. None of you ought to be on a passenger train. You have the idea in your heads that you own the road. To disabuse it, you will all go serve an apprenticeship on local freight until you can be considered common mortals again. Mr. Ellsworth, you and your fireman also must go back to a freight train until you learn something about combustion and how to avoid niggerizing passengers with a superabundance of black smoke, by "Jakey hittin' her right where she wanted it." Mr. Dailey, it is your heart I credit instead of your head. You violated an order by stopping your train between stations to let a passenger off without any orders. There are extenuating circumstances, and I, too, have a heart. You, Mr. Beardsley, used ordinary politeness when you addressed me, a supposed stranger. Yourself and your fireman are well spoken of by your master mechanic. You will both take engine 368 on trains 80 and 81. Mr. Dailey, your two men and yourself will be given the same trains, your hind brakeman acting as baggageman, and although it is very gratifying to see a train get from a station quickly, do not ever again expedite business by saying to a passenger, 'Gimme hoult of yer leg,' particularly a lady."



CANON DIABLO BRIDGE, SOUTHERN CALIFORNIA.

How King Edward Pays for Transportation.

The London correspondent of the New York *Tribune* says: Each leading railway company in Great Britain has constructed at its own expense a special train, which is reserved for the exclusive use of royalty. One company has two trains, one for the King, the other for the Queen. These trains are paid for by the King's treasurer on the following plan: First-class fare is charged for every member of the royal party and a shilling is added for each mile traveled. The companies hardly need the royal advertisement, and are not adequately compensated for the service rendered and the suspension and disturbance of traffic.

Two freight engines recently collided near the Kentucky town of Whitlock. Both were pretty badly damaged, and one engineer was discharged for carelessness and disobedience of orders. The funniest thing about the matter was the answer of the disobedient engineer to the other, who asked: "Didn't you have orders to meet me at Whitlock?" "Well, d—n it, hain't I met you?" said the engineer who caused the head-on collision.—*Argonaut.*

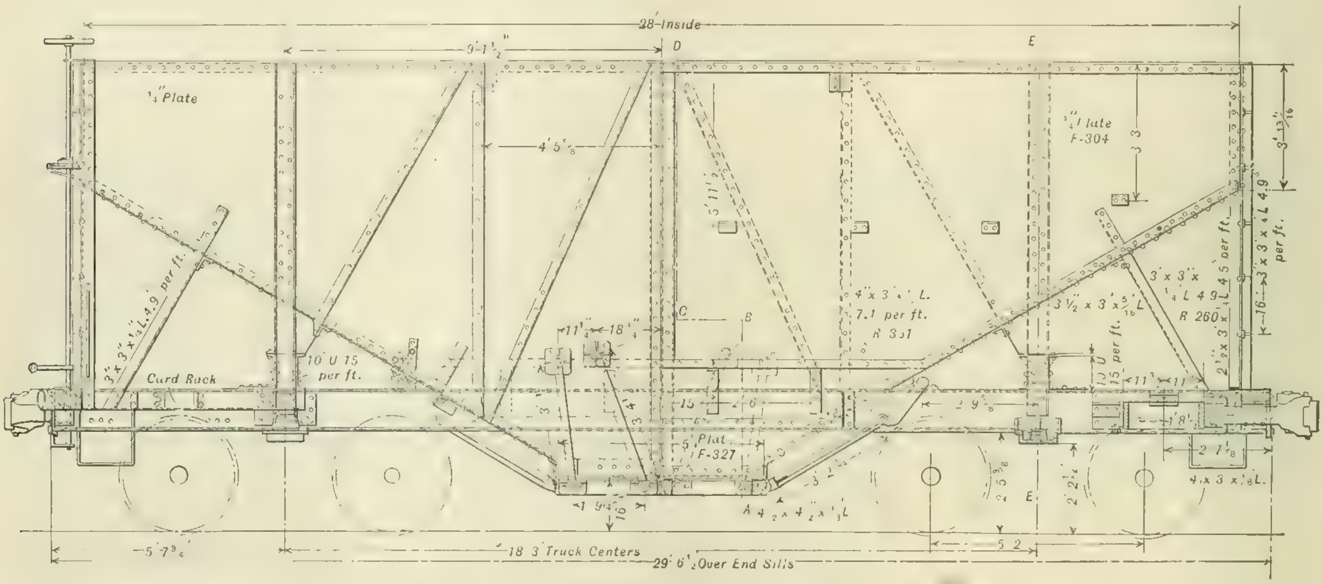
Vanderbilt Steel Hopper Car.

A design for a 40-ton steel hopper car for the carriage of limestone or other rough material has recently been brought out by Mr. Cornelius Vanderbilt, of New York, and it embodies several interesting features.

The center sills of this car with the two body bolsters form what may be called the ground plan of structure, and upon this I-shaped foundation the weight is carried. The center sills are two 12-inch channels, which extend out to the end sills, and taking the draw gear between them, place the line of pull only slightly below the sill center line. The body bolster is composed of two 10-inch channels which are placed on top of the center sills and are united above by a 5-8 plate which is extended up at an angle sufficient to meet the under side of the sloping hopper, and so act as a support to the latter. The weight of the car is, however, also transmitted to the ends of the body bolster by two upright channels which pass up on the outside of the car in the center of the two end panels. The car has no side sills, but the plates of which the hopper are composed are stiffened by a series of angles disposed so as to make the carside a truss structure like the members of a bridge or the framing of a box car.

The hoppers terminate in flat doors on the underside, which are supported, each by four hangers, two on a side. These are so placed that each door moves back, with slight drooping of the central edge, and takes up a new position under the hopper and out of the way. One hanger is slightly longer than the other, which has the effect of making the work of opening these gates an easy matter. The doors in action are each opened separately and do not slide back at any great angle. The opening and closing mechanism is strong, and as light as it can be made, and as the doors pass under and across the car from side to side, one shaft is sufficient for the operation of each. This flat or horizontally-placed door arrangement gives maximum hopper capacity, as the sloping hood covering the center sills is the only space in the interior of the car occupied by structural members.

The end sills are composed of plates backed by angles and are tied together from car end to car end by a couple of through rods. These rod ends support the draw-bar carrying irons. The outer corners of the end sills are braced by two channel struts, which reach the body bolster beside the center sills and are there all connected together by a flat plate. Upright angles connect the corners of the end sills with the corners of the hopper, and behind these are two angles which connect the end sill corners with the sides of the hopper further back. The design has been patented by Mr. Vanderbilt.



VANDERBILT STEEL HIGH SIDE HOPPER GONDOLA.

A Good Nerve Tonic.

Once upon a time the Prosperous Private Line did business with the Good, Slow & Easy Railway in the usual way. One day some P. P. L. cars went off the track while being delivered by a neighboring road. The strange part of it was that the cars were clearly on the tracks of the G., S. & E. Ry., while they were off, and that caused this railway to put forth effort. It turned out on examination that one of the P. P. L. cars had a loose wheel which fouled a frog point on a curve. The car left the rails and broke and bent two spring hangers in one truck, and somehow managed to break a coupler on the car preceding and the car following it. Both of these were also P. P. L. cars. When everything was put right, the worship of the goddess Stultitia was proceeded with in due form. The railway billed the private line for a loose wheel, two spring hangers repaired and two new couplers, less scrap. The P. P. L. replied that the loose wheel was all they could fairly be asked to pay for, as the rest was certainly "consequential damage." The railway pointed out that they had not asked to be reimbursed for repairs to damaged track or delay to freight, or for the expense of calling out a miniature wrecking gang in overtime, but had simply asked for the actual cost of necessary repairs to P. P. L. cars, due entirely to a failure of which the P. P. L. was clearly the cause. The P. P. L. did not dispute the statement of the case, they even expressed sorrow for the accident, but said that concerning giving up money to a railway they could not see it from where they sat, and offered to arbitrate, with consequential damage scenery artistically arranged in the foreground, while the G., S. & E. Ry. weakened considerably and let it go at that.

An auditor from the planet Mars, who looked over the books of both companies without their knowing it, found that the P. P. L. had got a tight wheel in place of a loose one, for which they paid, also two spring hangers repaired as good as new, for nothing, and two new couplers for two partly worn ones, without paying for the difference. The G., S. & E. Ry. had received only a specified small portion of the total outlay for work forced upon them so suddenly that the most expensive way of doing it was the only possible way for them. They had paid out cash on account of the P. P. L. and had filed away a neatly worded type-written expression of sorrow. The auditor, however, believes that consequential damage, with a very pale-colored tincture of sorrow added, makes a most invigorating nerve tonic.

General Correspondence.

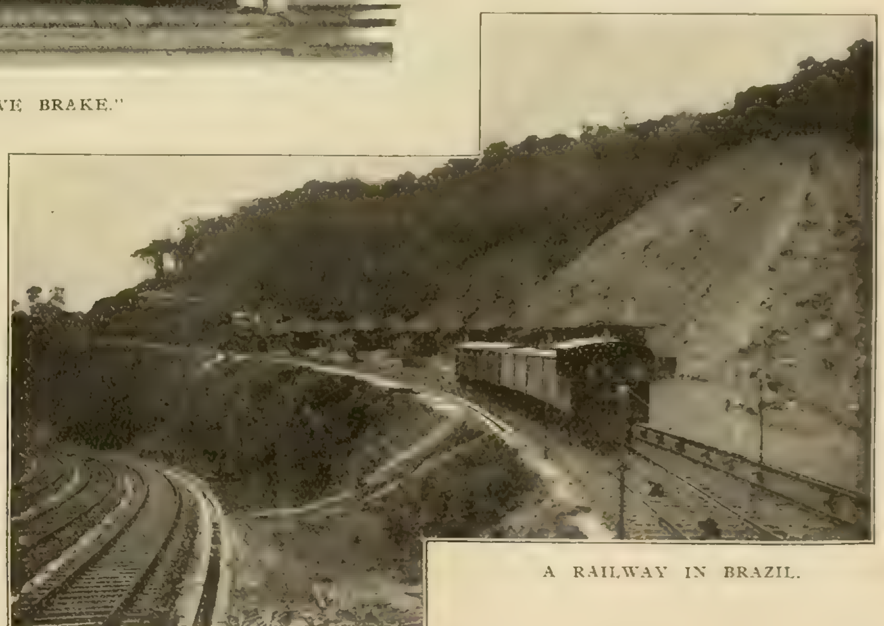
Sao Paulo Railway, the Coffee Road of the World.

BY O. HUBER.

A brief description of the port of Santos, from which is shipped three-quarters of the coffee exported from Brazil, will give the reader a fair conception of the enormous business done by one railway, in that product alone. The harbor of Santos is a well-sheltered one; with fine docks and large warehouses. Ten years

A "LOCOMOTIVE BRAKE."

ago the port had no docks. Sanitary conditions were almost unknown, and yellow fever had been epidemic many times. The Santos Dock Company have changed the port almost into a health resort. The docks are now over a mile in length, equipped with hydraulic cranes for handling heavy freight In the year 1901, nine million sacks, or 540,000 tons, of coffee were exported from Santos. Every sack of the nine million was brought into Santos over the Sao Paulo Company's line. This road is one of the model railways of South America; it is about 86 miles in length, and runs through a tropical country from Santos to Jundiahy, where it has several feeders, viz.: the Paulista Railway and Soracabana y Ituana Ry. The Mogyana Railway is a feeder for the Paulista, and taps that road at Campinas. Nearly all of the coffee is grown in the zone of the above-named roads. To handle this enormous traffic in coffee, besides other freight and passenger business, of which latter there is a large amount, the road is equipped as follows: Double track the entire length, interlocking switches at all stations, block signals, 90-lb. rails, 75 locomotives and 16 "locomotive brakes." The most interesting part of the road is what is called the "Serea" (meaning "hill" in Portuguese). The serea is 10 kilometers in length, with a gradient of 8 per cent., or 422.4 feet per mile. The road is double-tracked, but in a novel manner. Three rails are used, instead of four, except at passing points, which are half way up or down in each section. In this respect, it resembles the Lookout Mountain incline railway, which was illustrated in our October, 1902, issue. The "Serea" is divided into five sections,



A RAILWAY IN BRAZIL.

each separately operated by an endless cable, driven by a pair of 1,000 h.p. Corliss condensing engines. The up and down trains each use the middle rail until the trains come to the meeting point. There the road is double-tracked for a distance sufficient to allow trains to pass. It is impossible to miss this passing point, as both the up and down trains are gripped at certain definite points on the cable at top and bottom of the incline, when the cable is at a standstill. The cable being an endless one, the trains must necessarily meet just in the middle of each section. On this high grade no regular road engine is attached to the train. Each train on the incline has coupled to it what is called a "locomotive-brake." This is a combination of locomotive and automatic machinery used in connection with the cable. A rail grip may also be used in case of an emergency. All these appliances are worked by steam. The locotive-brake weighs about 32 tons. Trains move up and down in the following manner. The cable being at a standstill, then at the top and bottom of each section a locomotive-brake, with train coupled in front, is securely gripped on the cable. After this has been done, the engineman in the "brake" notifies the signalman. This is done by electric apparatus. Should trouble occur when the train is between any section, the engineman can use this appliance to call the signalman, as before. When both enginemen at top and bottom of the same section have given signals, indicating that their "brakes" are gripped to the cable, the signalman gives notice to the engineman in the power house, who then starts the engines connected to the cable on that section. When a train arrives at either end of a section, the locomotive-brake drops the cable of that section, and, being on level track, easily pushes the train ahead to the next section, and then grips the cable of that section. This procedure is repeated on each of the five sections. The locomotive-brake does no work when attached to the cable. It simply holds on. As a locomotive-brake is attached to each train,

one balances the other on the grade. The load gripped to each cable is about 120 tons. This part of the road can handle more tonnage in 14 hours than the other part delivers at present. During what is known as the "Coffee Season," as high as 90 trips are run on each section. The approximate tonnage handled in these 90 trips, over the incline, is about 20,000 tons. This includes weight of locomotive-brake, cars and freight. An average of 45 thousand sacks of coffee (2,700 tons) is shipped over the incline daily during the "coffee season." Each power station is equipped with an electric light plant. Express passenger trains make the run between Santos and Sao Paulo, a distance of about 49 miles, in 2 hours and 15 minutes. The trains are run in two sections over the cable, at a speed of about 12 3-4 miles per hour. It will readily be seen that very good time is made by these trains. After deducting stops, of which there are five on the serea, where the train is in two parts, and has to be made into one again at the top or bottom of the grade. Three other stops are made, or 8 in all. The entire freedom from accident on the cable section speaks well for the system and the management. Not a passenger has been killed since the road has been in operation, which covers a period of 30 years. Mr. John Harrison is Locomotive Superintendent, and Mr. Cecil R. Hillman Assistant Locomotive Superintendent. The writer is indebted to both of these gentlemen for information concerning the novel and interesting serea section.

Forces Moving Slide Valves.

In your September, 1902, issue, page 404, query of E. H. B.—Answer: There is no tendency to move a locomotive valve, either slide or piston, caused by steam in the steam chest, etc.

While the steam pressure in pounds per square inch is uniform, and the pressure per square inch on both sides of the valve exactly the same, yet there is a greater total force acting on the front end of the valve in the absence of a front extension rod, tending to push the valve to the back end.

As an example, take a slide valve on which the stem is 1 3-4 in. in diameter and steam chest pressure 150 lbs. per square inch, the force acting on the front side of the valve is $d^2 \times .7854 \times P =$ 360 lbs. d is the diameter of the yoke stem, P = steam pressure per square inch in the steam chest, and .7854 is well known. The same conditions also apply to a piston valve without a front extension rod.

Of course the frictional resistance of the valve stem packing and of the valve on the seat is greater than the unbalance load acting on the sides of the valve, but the tendency is for the valve to move back.

Referring to the last paragraph of this article: If the piston valve has a front extension rod and is pushed ahead, it is not quite clear to me why the valve might be forced back. Why would it be forced back if the extension rod is of the same diameter as the yoke stem? I can understand, however, that these conditions would exist where an extension rod is not used. S. J. DILLON, G. F. P. C. I.

Jersey City N. J.

Cause of Pound of Piston Valves When Drifting.

The question was asked in the December number of a railway magazine, "What causes piston valve engines to pound when drifting with lever hooked up?" The answer given was that this pounding is caused by compression in the cylinders, on account of the early closing of the exhaust when valve is running in short travel. This is a mistake. The pounding, which is in the rod brasses, is caused not by compression, but by the lack of it, on account of the valve opening for admission, and thus permitting the air which is being compressed to escape into the steam ways. There then being no resistance, the momentum of piston and connected parts takes up the lost motion in rod brasses with a jerk. The pounding can be stopped either by placing the lever in the corner or on the center—or, which is the better, by keeping main rod brasses filed. J. M. FOSTER, L. S. & M. S.

Collinwood, December 10, 1902.

Almost Acquired a Long Charter.

BY R. R. BUCKHAM.

There is no pleasure quite equal to mountain climbing. The stirring exercise in the open air sets the blood running a merry race, while the extended prospect, growing broader and grander with every step, uplifts the mind, and all that is mean and commonplace in life is utterly forgotten.

With the eastern tourist Mt. Washington is undoubtedly the favorite mountain summit to visit. The view which it affords is unsurpassed, and its top is easy of access, since one can make the trip by the footpath, the roadway, or the railway, as he prefers. The great majority of visitors to the mountain patronize the latter, as it is safe, convenient and speedy.

As one is slowly but surely borne up the steep and frowning mountainside by this achievement of mechanical skill and genius, he cannot but be impressed by the feasibility, the practical simplicity of this method of accomplishing a mountain ascent. Everything about the railway and its car and puffing engine works to a charm. There is no hitch or flaw anywhere from top to bottom. Upon making the trip up and back by this means, one would say at once that of course there was no more sensible, and ingenious, and commendable mode of carrying tourists up and down than this.

Little does the average passenger realize, however, what a storm of ridicule it aroused when it was first proposed. Sound and experienced railroad men regarded its inventor as little less than a maniac. When application was made to the New Hampshire Legislature for its charter, the idea was received with derision. During the debate which followed, one member of the House offered as an amendment that the charter be granted from the base of the mountain to the moon. Thus this little railway, but about two miles in length in all, came very near having the longest chartered line of any railroad in the country.

That Broken Whistle Valve.

On page 388 of your September issue I notice an article under the heading of "Broken Whistle Valve Causes Excitement," in which you give an instance of a broken whistle valve on a locomotive pulling a train into the peaceful town of Oyster Bay, causing the whistle to shriek for twelve miles approaching the station and for fifteen minutes after arrival. Could not the engineer have stuffed something in the bell of the whistle to prevent the noise and the consequent annoyance which it appears to have caused, for I have no doubt that a noisy noise annoys an Oyster Bayite?

F. G. MULLENGER.

Ongarue, New Zealand.

[The item referred to by our far-away correspondent was published without comment. On most railroads in this country there would be severe discipline meted out to the engineer who failed to stop the screaming of a whistle when the valve was out of order. It is a common practice to blow steam off the boiler through the whistle valve.—ED.]

Says That American Engines Burn More Coal Than Those Built in Great Britain.

A correspondent in Wellington, New Zealand, writes: "I have been requested to write to you for an explanation of how it is that the Baldwin engines which we have are much harder on coal than the British engines. The answer as far as I can make out is that the tubes are too short in comparison to the length of the firebox. I have been pushed to this belief through the temperature of the smoke box as found in the Baldwin engines, and in the engines of Scotch make. You would favor a number of subscribers if you would give them some information on the question asked."

[In regard to the letter from our cor-

respondent we would say that the tubes being too short would cause a great waste of heat. Our position, however, has always been that the difference in the course of operating the American locomotives as compared with those of Great Britain, is that our builders persist in making enormous steam and exhaust ports and we believe that heat is wasted through the increased clearance spaces, and also through the steam exhaust at the high velocity which the big exhaust port makes possible.—Ed.]

What Is the Matter With These Valves?

I am running a ten-wheel Baldwin passenger engine in mixed service. In leaving here as a helper on a three-engine freight train a few days ago, the head engine failed at the first station out (about 3 1-2 miles), and had to return to terminal, the conductor requesting me to return also with my engine in case the head engine failed altogether, which I did. We had to flag back and around several curves, and it being night did not exceed ten miles an hour either way, it being up hill going out. About 1-8 of a mile without doing any further damage. Now what caused blade to break, and in such an unheard of place? M. M. claims eccentric was hot when I came in, while I claim it was not, although I did not feel them on looking engine over, going such a short distance and so slow. I looked at all pretty good and none showed the least indication of being even warm, though when strap and eccentric were taken down next day they showed two blue places and looked very dry and rough, which I claim was caused by hostler when he moved engine after breaking down without disconnecting first the eccentric strap catching under firebox and acting all the same as a brake shoe would do when strap got bound as engine moved ahead, causing strap to get hot, for when I got under engine immediately after engine stopped the thick parts of strap were yet cool, the eccentric was still tight on shaft and strap was working quite free. After accident, in taking eccentric down next day, a piece was found broken where two halves bolt together. This engine has plain balanced valves and has troubled every nothing wrong. After starting up again engine was all right; stopped at water tank 4 miles further on and looked engine over again and still found nothing wrong, and lever did not bother any more for about 12 miles, then it commenced to act about the same, only not quite so bad, so I slowed down and went out to front end and gave engine some oil through release valves when matters improved somewhat, and I do this now whenever lever commences to cut up, though by the way it all starts so suddenly. I am looking for it to tear both sides of engine off some day, but hope not; have reported condition to R. H. foreman and had valves examined two or three times, but each time nothing is found wrong, with the exception that both valves have some wrought iron patches on face of them.

Both tallow pipes are O. K., lubricator working first class, and I use about 3 pints over division of 170 miles. When I left engine at water tank hostler claims he moved my engine with the one that was coupled in ahead, even spotting my engine at oil tank with it and it was after getting oil and moving

VIADUCT ON HOLYHEAD DIVISION OF LONDON AND NORTHWESTERN RAILWAY.

a mile from town the reverse lever commenced to jerk with engine drifting, which I judged was on account of wind blowing on lubricator and it not feeding good on account of backing up, so I went on pilot with oil can and gave engine some oil through release valves and lever was all right when I returned to cab. Made the stop at switch to roundhouse and worked steam to water tank (about 1-8 mile from switch), spotted engine, dropped reverse lever forward and then pulled it up on center and left engine with cylinder cocks open. Took torch and looked engine over and everything looked in first-class condition. Went with conductor to get orders to return to train, and while we were waiting for orders, hostler took engine to give it some more fuel oil. Everything went O. K. until hostler started to move engine away from oil tank, when things did not work just right with the result that L go-ahead blade broke at first bolt hole in eccentric strap. After the blade broke hostler moved engine ahead without disconnecting anything about engineman that has run her since she has been assigned to this division, the reverse lever jerking and cutting up at times all out of reason, sometimes when drifting and again at others when working steam. Only three days after accident (had been two days on work train after engine was repaired) I had to cut loose from freight train going up hill and let engine drift and give it a dose of valve oil through release valves before I could hardly do anything with her in regard to handling her share of train, and even after that it was a continual jerking for thirty miles up hill, but was O. K. coming back. Had valves examined and nothing was found wrong; although this was the first time engine bucked on me going up hill and working steam. The previous time was when after going down hill about 15 miles (in passenger service and speed about 50 miles an hour), the reverse lever jumped out of quadrant and went first back and then ahead, even when engine was about stopped it was as bad. I looked engine over, top to bottom, and found away from oil tank with hostler on my engine that the trouble occurred.

This same eccentric got hot and cooled off on its own account while engine was running in passenger service about 10 days previous to accident and did not cause any delay to train until after eccentric had cooled off and then got loose on shaft and allowed set screws to work out before I discovered it. The reason of it getting hot then was on account of the oil not working down to eccentric as it should have done (had it repacked on arrival at terminal). It being night time and rather chilly weather, added to this a fast run in the forenoon previous to this (which made eccentric kind of dry), and starting out with a speed of about 50 miles an hour, the reason seems very plain after thinking a little. We made a regular stop about 9 miles out and the fireman said he thought he smelled something hot, and I hurried around engine and felt everything but eccentrics in the few seconds we stopped there, but as I did not smell anything hot myself I did not

worry and went over to next water tank stop, but it was cold then. The reason I have stated this all is so that you can have a general idea of everything, and still the question is, what broke the blade? R. M. WATSON.

[Our opinion is that one side of the cylinder lubricator is not working properly. We should, however, like to have the views of our readers who have experienced similar trouble with an engine.]

Curious Heat Phenomenon on Fire-Box Sheets.

Will you please explain to me why the sheets in a fire box, exposed to the heat become cool after the water reaches the boiling point? I find from experimenting that the sheets are hot until the water begins to boil, then they become cool and the higher the steam pressure the cooler the sheets become. I can take a coal scoop and place it inside the fire door to shield my hand from the fire and lay my hand on the sheet and it is apparently perfectly cool. At the same time, the stay bolt heads are hot. This may be an old question, and I may be on a cold trail. However, I have never heard it explained. An early reply will greatly oblige, W. B. CHENOWITH,
Care Cotton Belt Shops.

We never heard of this phenomenon before, and cannot advance a theory to account for it. We should like to hear from other readers who have found the sheets cold when steam was in the boiler.—Ed.

Brake Beam with Natural Camber Reversed.

The C. & N. W. Ry. make a wooden brake beam in their shops at Chicago, Ill., which has the satisfactory feature of always keeping the nuts tight on the truss-rod ends. The stick of thoroughly seasoned wood from which the beam is made is sawed so that the resulting beam is slightly curved, in fact it has a camber of 3-4 of an inch with the grain of the wood in its natural position. This beam is bored for brake heads, truss rods and fulcrums, and when the truss rods are being put in place, the beam is bent in an air-operated press so that the 3-4-in. camber is reversed. The side which is naturally concave becomes convex. The fibers of the beam are therefore always in strain, and the tendency of the beam to right itself keeps the truss rod always in tension, with the result that neither shrinkage nor wear can loosen the pressure on the nuts on the truss rod ends, and everything stays tight. The fulcrums which in each case act as a strut between beam and truss rod, are made so as to be used for either right or left, as required.

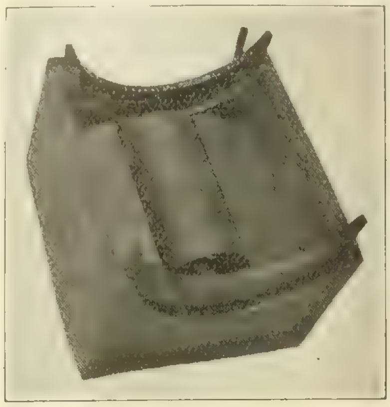
Spotter Made a Mistake.

One of the oldest conductors in point of service on the Big Four was greatly surprised when he received notice to go to Cincinnati and explain why he had not turned in a cash fare. But he was more surprised to learn that the report was made against him by a spotter on a certain date, and the explanation was made that on that date, near the front of a certain car, a woman had paid him a cash fare, and his report did not show this fare returned.

The incident was of so recent a date that he remembered about it. The woman had a ticket between the points mentioned in the spotter's report. She wished to buy some fruit from the news agent on the train, and asked the conductor to change a $10 bill for her. This he did, and in doing so came under the observation of the spotter. The conductor got an affidavit from the woman, stating the facts, and after 11 days' lay-off, he was reinstated.

The Cape to Cairo Railway.

The railway between Buluwayo and Salisbury, South Africa, via Gwelo, a distance of 300 miles, was completed on the 7th of October, 1902. There is, therefore, now through rail communication between Capetown and Beira. The completion of this new section will greatly facilitate the progress of the through Cape to Cairo line, which was a project dear to the heart of the late Cecil Rhodes. It will now be possible to supply railway material both from the Cape Colony and Beira ports. The line is laid for a distance of 80 miles north of Buluwayo in the direction of Victoria Falls. It is expected that the line will reach the Waukie coal fields early in 1903.—*Ex.*



THE NEW WAY.

THE OLD WAY.

THE GALVANIZERS.

The men who strive to keep axle boxes running cool. The men are not ornamental, but they are very useful.

Let no man turn aside, ever so slightly, from the broad path of honor, on the plausible pretense that he is justified by the goodness of his end.—*Barnaby Rudge.*

A War Monster.

The large gun recently made at the Government shops at Watervliet was intended to be transported by rail and a special steel flat car was built by the Baldwin Locomotive Works from designs by Mr. Alfred Christiansen, the master mechanic at the arsenal. The railway companies over whose lines it would have to travel declined to receive it, probably because the concentration of so great a load upon a wheel base something less than that of an ordinary flat car would have put an undesirable strain on their bridges, and in the event of derailment would have caused a most serious blocking of traffic. The gun was taken by water to Sandy Hook by the Merritt & Chapman Wrecking Company.

140-TON GUN ON STEEL FLAT CAR

The flat car which is now used for moving the gun in the Government yards presents some interesting features, which we are able to give through the courtesy of Captain O. C. Horney, U.S.A. It is 26 ft. 9 in. long and weighs 34,270 pounds. It is made with 10-in. steel channels for the side and end sills and with 10-in. I-beams for the center and intermediate sills. It is trussed with eight rods which come down 18 in. below the sills. The truck sides are steel plates flanged over on top. A steel T, from each of the beveled ends of the truck sides helps to stiffen the truck laterally. The axles are 6 1-4 in. in the center, the wheels seats are 8 in. diameter and the journals 6 1-4 x 10 in. The wheels are 30 in. in diameter, and the whole car is intended to run on a curve of 150 ft. radius. The gun itself weighs 285,000 pounds, and with weight of car, the axle load comes in the neighborhood of 79,000 pounds. There are over each axle box two coil springs, which, when the gun was in position, were compressed to half the amount provided for, and were therefore effective. The whole car is unique, and is, of course, a special vehicle intended for a special purpose.

Concerning the gun itself, it is a 16-in. breech-loading rifle, 49 ft. 3 in. long, 5 ft. in diameter at its rear portion and 5 ft. 2 1-4 in. diameter at the trunion band. The outside diameter of the muzzle is 28 inches. The projectile weighs 2,400 pounds, and will be fired with an initial velocity of 2,300 ft. per second. The weight of the breech mechanism is approximately 4,400 pounds and the powder charge is, roughly speaking, 600 pounds of smokeless powder, or about 1,100 pounds of black powder, while the computed maximum range is 21 miles. There are 96 grooves in the rifling.

TESTING 12-INCH KRUPP GUN AT MEPPEN

An idea of the enormous pressure generated in the powder chamber of a gun of this size may be had by quoting a few words of Sir Robert Ball, the eminent English astronomer and mathematician, when speaking of the pressures exerted on the interior of earth's mass by weight of the earth's crust. He says:

"The pressure due to the superincumbent weight of a mile of rock would be more than three tons on the square inch. At the depth of ten miles beneath the earth's surface the pressure, amounting as it does to over 30 tons on the square inch, would very nearly equal the pressure produced on the inside of a 100-ton gun when the charge of cordite has been exploded to drive the missile forth."

If it were possible to apply a suitable indicator and have the pencil draw a pressure diagram as the shot goes spinning down the rifled bore of the 140-ton gun, we would probably find that the expansion curve would sink rapidly and evenly away from the point of highest pressure until the base of the projectile passed out of the muzzle, when the propelling pressure would at once sink to zero. The diminishing pressure in the gun as the shot passes down the bore is roughly indicated by its tapering form.

At the muzzle, although the powder-gas does not exert any further pressure upon the shot and is thus practically wasted, the expansive force of the former is by no means reduced to nothing. The form assumed by the cloud of heated gas as it is forcibly blown out, without doing any useful work, proves the existence of an enormous pressure there, tending to rip open the mouth of the gun. It pours from the muzzle in the shape of a half sphere, somewhat resembling the bowl of a port-wine glass where it joins the stem. This interesting cloud formation is admirably shown in our illustration of the firing of a 12-in. Krupp cannon on the proving grounds at Meppen, in Germany, which is reproduced from *Harmsworth's Magazine*.

The hemispherical or port-wine glass form of the smoke cloud as it issues forth shows that the expansive force of

this gas, like all others in confined space, was acting in all directions, just as theory said it must act, though modified by its enforced flow through a long hollow cylinder.

It also proves that the gas, due to the ignition of powder, was very far from fully expanded at the moment when the "reeking tube and iron shard" parted company. The rotating shot, in its long, swift flight, leaves behind a huge, irregular, cotton-like puff of heavy smoke, while the gun backs against the recoil mechanism. The explosive missile having been urged to high velocity in the gun by the powerfully expansive force of the now harmlessly drifting cloud, bursts in the open sea, 20 miles out from land. It traverses this distance so swiftly that the sound of the explosion which drove it forth will be more than 45 seconds later in passing over the waters where the fragments of the shell have sunk.

Liquid Air.

In a lecture recently delivered by Prof. Cox to the students of McGill University at Montreal, some interesting facts regarding the effect of the low temperature of liquid air upon elasticity of substances were shown. The process of making liquid air was something as follows: A low and a high pressure compressor are connected and set working by a motor. Air entering the low pressure compressor is compressed to 16 atmospheres. Under the high pressure it is further compressed to about 200 atmospheres, or over three thousand pounds to the square inch. The gas is then dried first by leading into a cylinder, where by expansion it cools so as to drop most of its moisture to the bottom, and then, by leading through a cylinder of caustic potash, which, besides removing all remaining moisture, also removes any traces of carbon dioxide gas. The dried air is then led into the liquefier, a small cylinder, about seventeen inches high, in which are four sets of brass coils, two of which run down and two run up. The air goes down the coils, which run downward, and by sudden expansion at the bottom is cooled to a low temperature and about five per cent. of it is liquefied. The remaining gas then passes up the other two coils, which are so arranged as to cool the air coming down and then back to the condensers again.—*Ex.*

The people of Schenectady, N. Y., are beginning to realize the prosperity conferred upon a town by large manufacturing establishments. A statement was recently made that the American Locomotive Works and the General Electric Works combined employ 14,800 men, who receive in weekly wages $182,000, which is a little over twelve dollars per person.

The Development of the Locomotive Spark Arrester.

BY J. SNOWDEN BELL.

So much has been said and written, both historical and descriptive, relating to spark arresters, that it is difficult to avoid needless and tiresome repetition in another presentation of this important detail of locomotive construction. The subject is fully and interestingly treated by Professor W. F. M. Goss, of Purdue University, in his recent work, "Locomotive Sparks," and as that publication, together with the prior ones to which it refers, will enable the reader to study the spark arrester, both of the past and of the present, as fully in detail as he may desire, only the comparatively few leading and characteristic features of its development would seem to be of sufficient general interest to be here considered.

The facts, correctly stated by Professor Goss in 1902, that "the production of sparks constitutes one of the necessary

FIG. 1.

manifestations attending the action of a modern locomotive," and that "it is not possible under any circumstances to entirely suppress them," were doubtless recognized by those who were pioneers in locomotive building, as we find the spark arrester, in its crudest form, although embodying what seems to be considered an essential of the latest types, to have been applied as early as 1831, by the late M. W. Baldwin, of Philadelphia, who may be fairly termed the father of locomotive building in the Unitel States. This, which was presumably the first appliance of the kind, consisted of a convex sheet or basket of wire netting, secured to and covering the top of a plain cylindrical stack, which was flared out at its upper end to allow sufficient discharge area through the meshes of the netting. An accurate drawing of the first spark arrester is not obtainable, but it is illustrated sufficiently for present purposes in Fig. 1, which is reproduced from a sheet of drawings prepared by M. W. Baldwin & Co., in the early sixties, for use in litigation, which showed 57 different designs which had been developed prior to 1858.

As a basis of record date, we may note the first spark arrester patent ever issued, which was but little later than the original Baldwin appliance, being that of James P. Espy, dated June 29, 1833. As shown in Fig 2, it consisted of a cap which was fitted to turn on the top of the stack and was pointed or inclined on its front side and kept to the wind by a vane. The opening on the rear side of the cap was covered by a sheet of fine wire gauze. It was tested on the old

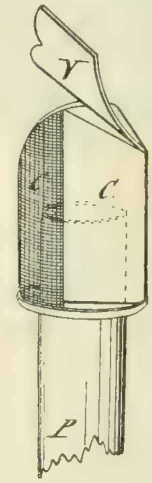


FIG. 2.

Philadelphia & Germantown Railroad, now a part of the Reading system, and also on the steamboat "Convoy," of the Lehigh Coal and Navigation Company, and highly commendatory certificates of its merits were given, but it does not seem to have made any further record or to have been continued in service.

Starting with the original Baldwin spark arrester of 1831, as a basis, the numerous proposed designs, as well as those actually put into use, have been worked out on two general lines; first, appliances located in the stack, and second, those located in the smoke box and used with an open stack. Of the multitude of these, of both classes, that have been produced, but few are worth examination, fewer still have gone into service at all, and scarcely any now survive except the diamond stack and the various detailed forms of smoke-box deflector and netting.

The development of the 1831, or what we may call the "stack" type of spark arrester, may be briefly traced, as it embodies only two steps of improvement which remain to any substantial extent in present practice; first, the addition of the

central deflecting cone, and, second, the change of the casing to the "diamond" form. The deflecting cone is claimed to have been designed and used by Isaac Dripps on the Camden & Amboy Railroad in 1833, and is shown in a drawing presented by him at the 1884 convention of the American Master Mechanics' Convention (Proceedings p. 41, Plate No. 28 A). This construction, which is represented on a larger scale in Fig. 3, is marked on the plate referred to: "This Spark Arrester was designed, built and used in June, 1833. Designed by Isaac Dripps," and the correctness of the date does not appear to have been questioned. It will be observed that this design embodies all the elements of the so-called "balloon" or "bonnet" stack, which, at a much later date and for a considerable period, was generally and almost universally in use on American railroads.

The second stage of development and latest form of spark arrester of this type, which still continues in service to a considerable extent, is the well-known diamond stack, one of the latest applications of which is shown in Fig. 4, and which is so familiar that description is unnecessary. Without entering upon a discussion of its merits, it may be noted that it was sufficiently "modern" in 1901 to have been put on large compound prairie type engines of a C., B. & Q. R. R. standard pattern (B. & M. R. R.), as is shown by an illustration furnished by the builders to the New York Railroad Club and appearing on page 50 of the Proceedings of November, 1901.

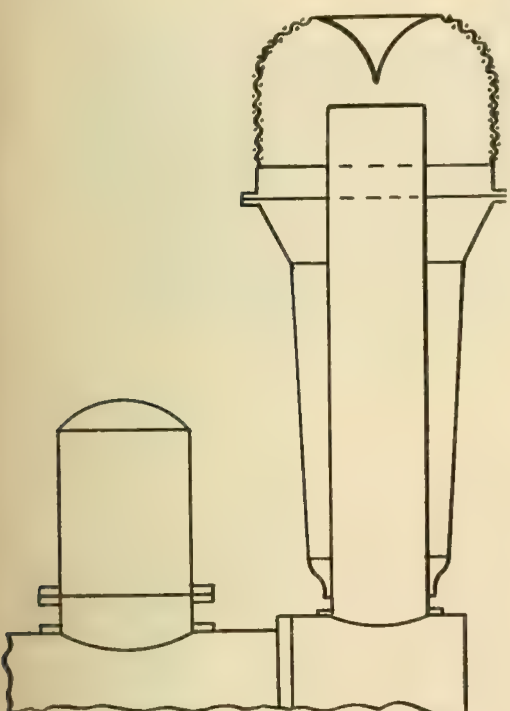


FIG. 3.

It will doubtless be a surprise to some readers to know that diamond stacks without any netting whatever have been, and probably still are, successfully employed in regular service on the Mexican Central Railroad.

J. SNOWDEN BELL.
ENGINEER AND PATENT ATTORNEY.

The second line of spark arrester design which has been previously indicated, i. e., appliances located in the smoke box and used with an open stack, will now be briefly considered, and in view of its indorsement and general adoption in the most approved recent practice, it would seem that its originator, who, in the lapse of time, has apparently been completely forgotten, should be recognized and awarded the place in the history of the art and the measure of credit to which he is entitled. So far as record evidence is available, the "smoke-box" spark arrester was first proposed by J. McIlvaine, of Philadelphia, in 1833, in an article contributed by him to the journal of the Franklin Institute, Vol. XII, N. S., 1833, pages 74-77. The wood cut illustration of McIlvaine's design which is there given is reproduced in Fig. 5, and, after stating objections to a wire net at the base of the chimney or a wire basket on the top of the chimney (1831 pattern), he thus describes it:

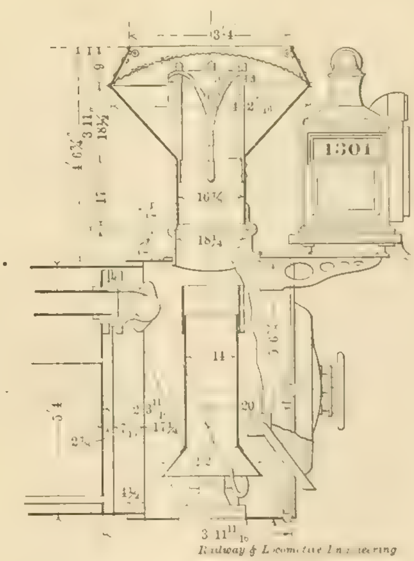


FIG. 4

"These objections will, I flatter myself, be effectually obviated by placing a screen of wire in the smoke chamber, as seen in the accompanying figure; the diagonal position allows a net of ten times the area of the flues, while almost all the vapor will come in contact with it nearly at right angles; if we allow one-half for retardation, we still require but one-fifth the velocity of the draught through the flues, and one-sixth of that in the chimney, a retardation which seems to be amply sufficient to allow the burning coals to fall; if, however, these are retained on the wires, not having the steam and condensed water thrown upon them, they will be consumed."

McIlvaine never patented his design and does not appear to have put it into service, but, as will be readily seen, it is the basis upon which all spark arresters of this type have been worked out, and shows an intelligent appreciation of operative conditions existing when he wrote as they do now.

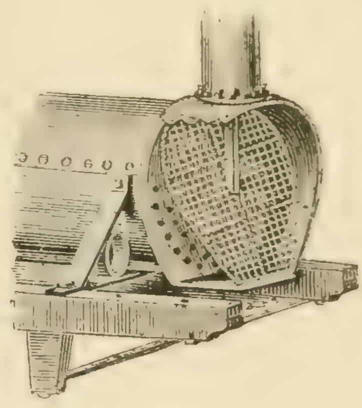


FIG. 5

While McIlvaine's design provides, in some measure, the deflecting plate which appears, in one form or another, in almost all the present constructions of this general type, he did not apparently contemplate its use in this regard, and, considering his new feature to have been merely a smoke-box netting, the second and final stage of development of ruling features of the type was apparently

reached by Isaac Dripps, who, as appears, from the 1884 Proceedings of the Master Mechanics' Association, designed an inclined deflecting plate located in front of the tube sheet, in 1849. Fig. 6, which is reproduced on a larger scale from Plate No. 28E of the Proceedings, shows the Dripps design, which bears the following notation: "Arrangement of Deflecting Plates in front end of Boilers for Burning Anthracite Coal, C. & A. R. R. Designed by Isaac Dripps in 1849." Both the deflecting plates are marked "Perforated."

The differences between the various forms of smoke-box spark arresters now in service are practically only in detail, and all of them are more or less perfected embodiments of the rudimentary McIlvaine and Dripps designs. It would probably be neither useful nor interesting, even if space permitted, to present many examples, and the two following instances, both of quite recent practice, which have been selected as being fairly representative, and worked out on sound theory and correct application, will suffice to enable an intelligent conclusion to be arrived at as to the principles of construction which seem best fitted to answer the present conditions of railroad service.

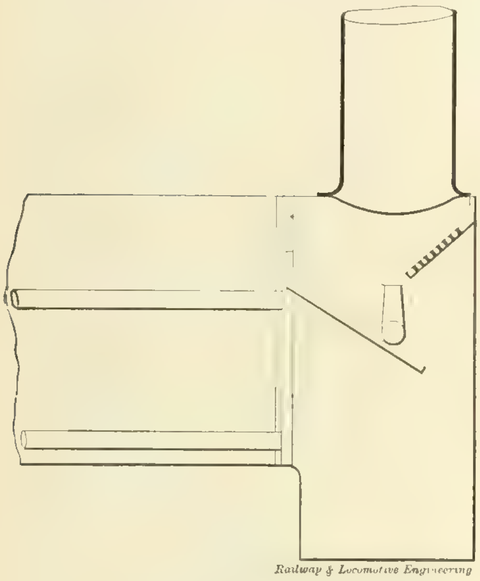


FIG. 6.

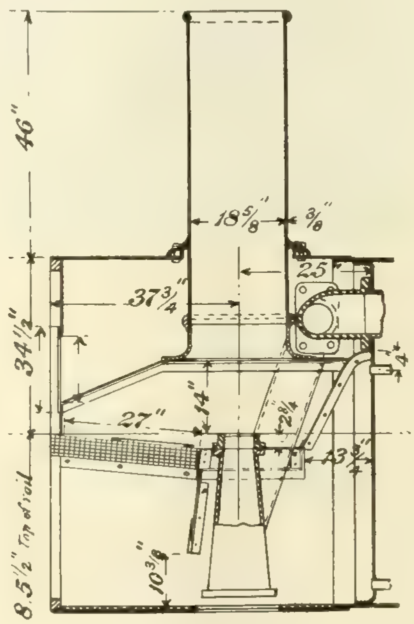


FIG. 7.

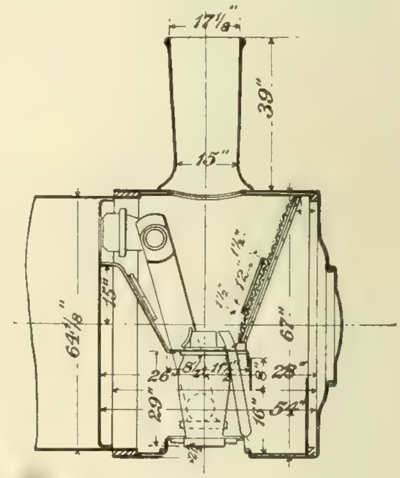


FIG. 8.

The first of these, illustrated in Fig. 7, is the design of Mr. J. E. Muhlfeld, recently of the Intercolonial Railway, of Canada, on which road it is stated to have been applied with excellent results to 25 engines. While it was doubtless original with Mr. Muhlfeld, its merit will not be at all diminished by the fact that it is essentially a reproduction of a plan proposed by Zerah Colburn in 1854. In an article published by Colburn in that year, after correctly stating that the volume of the smoke box should be "reduced to the smallest possible extent," he says:

"A plan which I proposed some time since for the relief of the draft of engines on a line having low bridges, which plan I have lately learned was tried with good results some time since on the Columbia road [now part of the Pennsylvania Railroad], but for some reason was not continued in use, was to place a level sheet of iron across the smoke box just above the upper row of tubes. This would reduce the contents of the smoke box and consequently the amount of air to be lifted out. It would allow of extending the chimney downward, and of thereby increasing the effective length and also of lowering the blast pipes and substituting blast pressure for blast suction. I look to this plan as one likely to become generally applied."

An English-built locomotive having its smoke-box reduced in dimensions, as proposed by Colburn, is shown in Plate XLIII of "Recent Practice in the Locomotive Engine," London, 1860, and the successful performance of Mr. Muhlfeld's design encourages the hope that Colburn's prophetic view may, after the lapse of nearly 50 years, be realized.

The latest, and in the judgment of the writer, probably the most perfect and practical development of the smoke-box type of spark arrester that has been put into railroad service, is that shown in Fig. 8, which is used in wide firebox switch engines recently built by the American Locomotive Company's Brooks Works for the Lake Shore & Michigan Southern Railway.

The appliance is, in this design, brought to its lowest terms—the deflector and netting—and these are so proportioned and disposed as to reduce the length and volume of the smoke box to, or nearly to, the minimum, and to make the front a self-cleaning one, the useless cinder hopper being therefore dispensed with. The fallacy of the claim made by the advocates of the extension front that it acts as a spark retainer has been so generally recognized, and the dwindling down of its proportions in recent approved practice is so marked, that a discussion here of its unmechanical theory and practical objections would needlessly consume space. The Lake Shore design evidences that all the netting area that is necessary can be located in a smoke box whose front is only 28 in. from the center of the exhaust pipe, and it will be readily seen that it could be made even shorter if desired.

The Muhlfeld design is also a self-cleaning front, and, except as to the substantially horizontal plate which cuts off the upper portion of the smoke box from the draft, it accords with the Lake Shore construction in using only the deflector and netting. It would, however, seem that the desirable result of reducing smoke-box volume could have been more fully attained by shortening the front about 10 inches and running the netting on an incline from the bottom of the deflector to the upper division plate. Such a modification, which would retain all the useful features of the design and affords ample netting area, would, if used with a correctly proportioned taper or choke stack, appear to embody all the elements which go to make up a practical and successful front end.

Personal preferences and prejudices, and, to some extent, the character of fuel and service, operate to prevent any organized effort toward the adoption of a substantially standard spark arresting locomotive front end, but there is no good reason why conflicting views cannot be measurably harmonized and the principal difficulties in the way of prog-

ress in this direction be removed. Mr. William Forsyth, who will be recognized as good authority, very aptly said, in 1899, that "the only remedy for the difficulties that we have been trying to overcome with draft appliances is to enlarge the grate area," and as the best and almost the universal practice since that date has adopted the wide firebox, the problem is now of correspondingly easier solution.

In the present stage of development of the locomotive spark arrester, and in the light of generally expressed experience, the best results can, in the writer's opinion, be attained upon the following lines:

Under certain conditions, the diamond stack will be found most desirable, and, in some cases, may be indispensable.

For general service a spark arresting appliance located in the smoke box and used with an open stack will be found best adapted to present conditions and presents the most available basis for a standard front-end design.

The essential features of such design should be (*a*), that the smoke box be of the minimum volume which will contain the spark arrester and draft appliances, and should, therefore, be as short as possible; (*b*), that it should be of the "self-cleaning" type, with appliances adapted to disintegrate the reduced quantity of cinders which pass out of a wide firebox and discharge them without liability to set out fires; (*c*), that a deflecting plate, single sheet of netting, and (perhaps) a petticoat pipe are the only necessary elements of the spark arrester, and (*d*), that the plan of partition between the upper and lower portions of the smoke box and inwardly extended stack, as proposed by Colburn and revived by Muhlfeld, appears to be of such substantial advantage as to recommend its adoption, or, at least, its careful and thorough consideration, in the preparation of a front-end design which will satisfactorily meet the requirements of railroad service under the exacting conditions of its present operation.

Fast Passenger Engine for the Vandalia Line.

The Vandalia Line have recently purchased four fast passenger engines from the American Locomotive Company, which were built at the Schenectady shops. As will be seen by our illustration the engines are of the 4-4-2 type, simple, with 20 1-2 x 26-in. cylinders, and driving wheels 78 ins. in diameter. The total weight is 164,500 lbs., of which 91,500 lbs. rest upon the drivers. The machine is capable of exerting a pull of about 23,800 lbs., and the ratio of adhesive weight to tractive power is 3.84. The slide valves are American balance and are actuated by an extension rod passing over the forward driving axle, and the motion is direct. The rocker is placed in front of the yoke and makes therefore what may be called a crosshead connection with the valve rod.

The driving wheel tires, as is usual with wheels of large diameter, are held on the wheel centers by shrinkage, and as an extra precaution, by retaining rings. The engine frames are crossbraced by a flat bar which is held in place by the pedestal binder bolt at the back of each of the main pedestals.

The arrangements in the cab have been made with an eye to the convenience and comfort of the enginemen, and among other things the injectors have been placed on the boiler head, the delivery pipes running through, inside the boiler, to the front, with downwardly pointing openings. The boiler is of the radial stayed straight-top type, with wide firebox. The heating surface is ample, being in all 2,986½ sq. ft., of which about 2,816 ft. are in the tubes.

The tank is made with a water bottom, and the fuel space is of the gravity hopper type. The coal capacity is about 12 tons, and the water carried amounts to 7,000 gallons.

Some of the principal dimensions are subjoined for reference:

Cylinders, 20½ x 26 in.

VALVES.

Greatest travel of slide valves, 6 in.
Outside lap, 1⅛ in.; inside, line and line.
Lead of valves in full gear, line and line; full forward motion, [illegible] in. [illegible] cut off.

WHEELS, ETC.

Dia. of driving wheel outside of tire, 7[illegible] in.
Eng. truck, 4 wheel swing bolster with 3 pt. hgr.
Dia. of engine truck wheels, [illegible] in.

BOILER.

Outside dia. of first ring, [illegible] in. Work. press. 200 lbs.
Thickness of plates in barrel and outside firebox, [illegible] and 1 in.
Horizontal seams, butt joint sextuple riveted with welt strips inside and outside.
Circumferential seams, double riveted.

FIREBOX.

Lgh., 102 in.; wdh., [illegible] in.; dph., [illegible] in. F., [illegible] in. B.
Plates, thickness, sides, 5/16 in.; back, ⅜ in.; crown, [illegible] in.; tube sheet, [illegible] in. Stay bolts, 1 in. dia.
Tubes, material, charcoal iron No. 11; number of 338; dia., 2 in.; length over tube sheets, 16 ft.
Heating surface, tubes, 2,816.87 sq. ft.; firebox, 169.8 sq. ft.; total, 2,986 67; grate area, 46.36 sq. ft.
Smoke stack, inside dia., 16 in.; bottom, 17 in. top; top above all, 15 ft.
Tender, weight, empty, 55,000 lbs., wheel base, 21 ft. ½ in.; tender frame, 10 in. steel channels.
Total wheel base of eng. and tend., 58 ft. 5¾ in.
Brake, Westinghouse, American on all drivers and trailer operated by air, with high speed brake attachment. W. A. A. B. for tender and for train. 2 main reservoirs 16 x 54 in. 9½ in. LH. air pump.
Engine equippe' with trailing truck back of main drivers, with 48 in. wheels, journals 7½ in. dia. and 12 in. lg., with outside bearings.

FAST PASSENGER, ATLANTIC TYPE ENGINE FOR THE VANDALIA LINE.

Locomotive Trying Superheated Steam.

The officials of the Prussian State railways have been experimenting with an apparatus for superheating steam with rather unfortunate results. Near Berlin the engine had to slow down before a station, when from some cause the firedoor sprung open as if by an explosion within, and a sheet of flame issued which enveloped the whole footboard.

It struck first the fireman and set his clothes on fire, and he was fatally burned; Cordes, head inspector of the Grunewald shops, jumped and had his right hand crushed by a passing freight train, so that it was necessary to amputate his forearm. Garbe, a member of the Berlin State Railroad Directory, had one side of his face burned, but was not seriously injured.

Railway and Locomotive Engineering

A Practical Journal of Railway Motive Power and Rolling Stock.

Published monthly by

ANGUS SINCLAIR CO.,

174 Broadway, New York.

Telephone, 984 Cortlandt.
Cable Address, "Loceng," N. Y.
Glasgow, "Locauto."

Business Department:
ANGUS SINCLAIR, President.
FRED M. NELLIS, Vice President.
JAMES R. PATERSON, Secretary.

Editorial Department:
ANGUS SINCLAIR, Editor.
F. M. NELLIS, GEO. S. HODGINS, JOS. A. BAKER, Associate Editors.

Advertising Department:
Eastern Representative, S. I. CARPENTER, 170 Summer St., Boston, Mass.
Western Representative—J. A. BAKER, 1204 Monadnock Block, Chicago, Ill.

British Representative:
THE LOCOMOTIVE PUBLISHING CO., Ltd. 102a Charing Cross Rd., W. C., London.

Glasgow Representative:
A. F. SINCLAIR, 7 Walmer Terrace, Ibrox, Glasgow.

SUBSCRIPTION PRICE.

$2.00 per year, $1.00 for six months, postage paid to the United States, Canada and Mexico. For other parts of the world, $2.50, or ten shillings. Single copies, 20 cents. Remit by Express Money Order, Draft, Post Office Order or Registered Letter.

Mailing address can be changed as often as necessary—always give old and new address, and if you subscribed in a club state who got it up.

Please give prompt notice when your paper fails to reach you properly.

Entered at Post Office, New York, as Second-class mail matter.

The Frictional Limit.

Tractive effort, or tractive power, or in plainer words, draw-bar pull, may be calculated for a simple engine by squaring the diameter in inches, of the cylinder, and multiplying that quantity by the stroke, also measured in inches, and again multiplying this product by the mean effective pressure in the cylinders given in pounds, and dividing the whole by the diameter of the driving wheels, expressed in inches. After working out this problem for any particular engine, we get what school boys call the "answer." This answer is theoretically the number of pounds which the engine in question could pull up out of a well, if a frictionless cable and pulley were properly arranged behind the tender. That weight, whatever it is, represents all the engine can do, at a slow speed, on a good rail, and without slipping.

Suppose that the engine, having drawn a certain weight slowly up out of a deep well was to stand with brakes set while some slight addition was made to the weight. Obviously, the weight which came up represented the engine's maximum effort, and therefore any addition to it would cause the whole mass to descend, and the engine would be slowly slid backward when brakes were released as the weight went down. If, however, steam was used against this backing-up motion caused by the weight, the wheels would slip, and though there might be a slight reduction of the speed, the engine would nevertheless continue to go back with slipping, or even with locked drivers, just as a child might drag a toy engine along the floor, with wheels and axles bent so as to prevent their rotation. The utmost resistance which the locomotive could offer, in this tug-of-war, without using its tender brake, is the friction of its locked driving wheels on the rails.

Trautwine's engineer's pocket book gives the co-efficient of friction for steel on steel as 0.14. The co-efficient of friction is the fraction expressing what proportion of the weight of a moving body is required to slide it along. A steel block weighing 1,000 pounds would therefore require 140 pounds horizontal pull to slide it along a smooth, clean steel floor. Now, although locomotive tires standing on railway rails is a case of steel on steel, yet Trautwine's figure would be far too low for use in the example before us. Trautwine's co-efficient was deduced from experiments, made in a laboratory, surrounded by ideal conditions, such as absolutely smooth and perfectly clean surfaces in contact, and not a trace of lubricant anywhere. In everyday life out of doors on railway track, as we know it, the conditions are anything but ideal, and the co-efficient of friction usually taken for steel tires on steel rails is 0.2. This is higher than Trautwine's figure for smooth, flat surfaces, possibly because the wheels being convex and standing on flat rails tend to bring the molecules of steel in each, into somewhat closer contact, even though the surfaces may be slightly lubricated by grease or moisture, while the presence of dust or grit always assists the wheels to hold and the surfaces are never quite smooth. Our steel block of 1,000 pounds would require, with 0.2 as the co-efficient of friction, not 140 pounds to slide it, but 200 pounds under ordinary railroad conditions.

Applying this to our slowly-backing engine, we see that if it had 100,000 pounds on the drivers, then anything over 20,000 pounds in the well, would pull the engine back, and it would do this without reference to what the tractive power might be as calculated by the formula given in the opening paragraph of this article. The aim of designers is to have the tractive power of the engine worked out as close as is necessary to this limit of friction between wheels and rails. If the engine is so built that the tractive power is considerably above this limit, the engine will be "slippery." To push the illustration to an extreme case, an engine as light as a hand-car, with calculated tractive power equal to that usually possessed by a 17x24-in. cylinder engine, would only be able to use an amount of tractive power equal to its adhesion. If, however, the tractive effort is much below the friction limit, the engine could not develop its full power. The co-efficient of friction between wheels and rails being taken at 0.2; then, theoretically, as far as friction is concerned, an engine is supposed to be able to pull about one-fifth of the weight on its drivers, or at least this is the limit which designers keep in view. It is clear that if the weight on drivers be divided by the tractive effort, the result will be some whole number, and this number is called the ratio of adhesive weight to tractive power. If the weight on drivers is 100,000 pounds, and the tractive effort is 20,000 pounds, then the ratio of adhesive weight to tractive power is 5, and when this result is tested as regards the frictional limit, we find that the reciprocal fraction 1-5, or 0.2, expresses the ability of the engine to exert a pull equal to one-fifth of the weight carried on the drivers.

As a matter of fact, passenger engines are often designed so as not to come exactly to this frictional limit. Good practice allows the ratio of adhesive weight to tractive power to be 4, and permits 4.5 for freight service. This arises from the fact that a passenger engine is not expected to work up to her theoretical limit, when cutting off short at regular speed, and the chances of slipping are, to a certain extent, disregarded. A freight engine in service approaches nearer to the limit owing to the average cut off being later and less chance of slipping is taken, while good practice places a yard engine as nearly as possible at the limit, *i. e.*, 5, so that the chance of slipping is reduced to a minimum. The designer has always two objects in view—not to seriously over-cylinder the engine, nor to let the adhesive weight predominate so as to make the engine work below her legitimate capacity. These are the two dangers which he wishes to escape. It is sometimes difficult steering, for in successfully avoiding the rock Scylla, he runs the chance of being swallowed up in the whirlpool of Charybdis.

Halsey on the Metric System.

People who are on the aggressive in every fight generally have an advantage over those who are on the defensive. This has been very well illustrated by the vigorous assault long carried on by theorists and visionaries in favor of the adoption of the metric system of weights and measures. These people are making headway over those who are interested in letting well enough alone, and there appears to be no misrepresentation or subterfuge they will refrain from stoop-

ing to in pushing their hobby while the people whose interests are against a change, seldom do anything to demonstrate the weakness, shortcomings or falseness of their opponents' positions.

The American Society of Mechanical Engineers have generally been sound in opposing the compulsory use of the metric system, but the school theorists have been forcing their views to the front recently, and last spring they got a resolution passed by the society condemning the action of a committee which went to Washington and opposed the compulsory introduction of the metric system. At the last meeting of the society Mr. Fred H. Halsey, assistant editor of the *American Machinist*, read a paper on the metric system, in which he told very salutory truths about the misrepresentations and falsehoods indulged in by the advocates of the metric system. If the manufacturers and others whose interests will be infringed and whose business will be imposed upon by being compelled to adopt the metric system, will read Mr. Halsey's paper, we feel assured that they will be stirred into active resistance to the proposed change.

In his introduction to the subject Mr. Halsey says: "The pro metric argument is substantially an *a priori* argument. The metric advocate adopts the methods of the old philosophers who laboriously sought to prove what ought to be. The method is that of modern science which interrogates nature in order to find out what is. For instance, they tell us how easily and how quickly this nation ought to make this change; I shall show how slowly and laboriously France and Germany have made the change. They will say that we ought to adopt this system to please our foreign customers; I shall show that our foreign customers do not care one picayune whether we adopt it or not, and I shall prove it by a flood of evidence.

"The evidence is plainly given, and cannot fail to be convincing to minds open to conviction."

The society's summary of Mr. Halsey's paper reads:

"The actual use of the metric system in countries where it has been adopted is discussed and the confusion of units is shown to have been increased rather than diminished. Particular reference is made to the textile industries in France and Germany, where the old units of the native systems and the units of the English system are more commonly used than the metric units. It is argued that the adoption of the metric system means the abandonment of mechanical standards now existing, if the metric system is to replace the English system in machine practice. The advantages claimed for the metric system are called in question, and particularly the advantage in making calculations is discussed. It is shown that in the machinery for export to countries now using the metric system the only dimensions which have been changed are the pitch of screws, such as traversing and elevating screws for milling machines, and lead screws for lathes. It is claimed that the machine building industry and particularly the machine tool industry are the foundation of modern industrial life, and that these will be seriously affected by any change which involves the abandonment of present mechanical standards. Very full data and illustrations are presented in support of the arguments."

The Grand Trunk Pacific.

The Grand Trunk Railway of Canada is now definitely in the field with a transcontinental project which has been received with great favor by the people of the Dominion. The press comments over the border on the undertaking are, however, various and interesting, and with few exceptions the government policy in the matter is expected to be that of reasonable aid, rather than of extravagant or over-generous assistance. A map published by the Montreal *Star* shows the route of the proposed line from Toronto to North Bay (already in existence), thence the road will run about 100 miles to the north of Winnipeg, with a branch to that city, and from the junction point on to the Rockies it will average from 100 to 200 miles to the north of the international boundary. It will probably pass through Edmonton, and will reach the tide water of the Pacific at Port Simpson or Bute Inlet, or perhaps at both these points. In fact, in a general way it appears to be the intention to follow the survey made by Sir Sandford Flemming in 1872, for the Canadian Pacific, which route was afterwards abandoned for a more southerly location. In this connection it is interesting to read in the Canadian press that the riches and variety of resources in the Canadian West had to be proved before this "Doubting Thomas" of transportation companies would make any move. Some papers have dilligently dug up ancient history and refer to the fact that when the Canadian Pacific project was started the Grand Trunk fought it in Canada and in Great Britain, and sought to depreciate the country's credit because of its financial support of the enterprise. It is humorously pointed out that the Grand Trunk people are now prepared to build a second road through a country in which they professed to believe it madness to build even one. But the construction of the Grand Trunk Pacific, we are also told, will not be the task of pure faith and pioneer difficulty which the building of the C. P. R. was. It was predicted by a politician of early days that that line would never even pay for axle grease, now the valley of the Saskatchewan is said to have scarcely as yet been traversed by the white man, and its illimitable possibilities are only beginning to be grasped.

The Canadian Pacific was undertaken partly as a national work, for the purpose of developing the country and of binding together the provinces of the Dominion. The ultimate completion of that railway was one of the conditions imposed by British Columbia before joining the federation. The Grand Trunk, however, will build their line as a private corporation for profit. That such profit might reasonably be expected, may be judged from the recent public utterance of the Hon. A. G. Blair, the Canadian Minister of Railways and Canals, when on his return from the Northwest he said that four lines of railway, instead of one, are actually needed to move the present crop from Canada's wheat lands.

There seems to be satisfaction felt that the new line will not be managed from London, but that the majority of directors on the board will be Canadians, and that a large part of the capital required for the work will be obtained in Canada. The road now being built in the Northwest, the Canadian Northern, is believed by some to be destined to be absorbed by the Grand Trunk, but at present, that is, as Lord Dundreary said, "one of those things no fellow can find out." At any rate, notwithstanding the hunt for ancient history and the twitting of railway magnates with the attitude of their predecessors, the extension of the Grand Trunk system to the Pacific Coast, appears to be a substantial project which will be pushed through with the characteristic energy of our northern neighbors to a successful completion within the next few years.

Surveying Instruments Used in Machine Shop.

People familiar only with the comparatively small pieces handled in railway shops will be surprised to learn about articles to be machined being so large that a surveying instrument was employed to adjust the work and the machines. An operation of that kind was described by C. C. Tyler in a paper presented at the last meeting of the American Society of Mechanical Engineers. The society's summary of the paper says:

"The author describes the use of a surveying instrument for laying out work where the dimensions are so great as to demand the use of portable machine tools secured to a large floor surface plate, the tools being moved rather than the parts which are being machined. The surveying instrument is of special contruction for dividing and leveling, arranged to be mounted on a center column. The application of this method to

the machining of a cast-iron ring over 20 ft. outside diameter and made up of six sections, is described in detail and illustrated by photographs of the actual operations. The floor plate used is 48 ft. wide by 176 ft. long, consisting of 132 sections, each 8 ft. square, keyed and bolted together. The whole plate is grouted in place upon brick piers, these resting in turn upon a bed of concrete, 3 ft. 6 in. in thickness. Chips fall through into tunnels underneath the floor plate and are cleaned out through trap doors. The surveying instrument was used for setting up portable tools and getting them exactly in line, and for proving the accuracy of the finished work on the cast-iron ring. The special dividing and leveling instrument is described and illustrations shown."

Per Diem and Demurrage.

The per diem method of paying for freight cars was put into operation for the purpose of hastening the loading, forwarding and release of cars, and when released, the return of foreign cars to owners. Such in effect, was Mr. Casey's definition of the system, given in a paper recently read before the New York Railroad Club. These results are, of course, brought about through the operation of the system, but there are other incidental advantages which greatly enhance the usefulness of this new departure in railroad operation. The money value of the prompt handling of car equipment has been almost reduced to the clear outlines of what Mr. James Skeevers would call an "object lesson," and the teachings of the lesson, in a greater or less degree, have reached all departments with correspondingly good results. The system has brought into intimate business relations, officers who may previously have had only a nodding acquaintance. In this way it has developed co-operation, to the great advantage of the road so served. In addition to being absolutely honest, this method tends to reduce the amount paid out for car rental, considerably below that which would have been expended under the mileage system.

In the five months ending November 30, 1902, the Lackawanna Railroad had 2,775 cars of their own equipment at home, beyond the number for the corresponding period in the previous year, or equal to a daily average increase of nearly 15 per cent., and from July to October, though that road had 16 1-4 per cent. less cars out on foreign lines, the earnings were only 7 per cent. less under per diem.

These figures speak volumes. The increase of cars at home was like money found in the street, during the rush season, as it had not been experienced before. The reduction of the number of cars abroad was highly satisfactory, because if 100 cars had earned $100 under the mileage system of payment, the new regime enabled 84 cars to earn about $93. The benefits here shown as due to per diem affecting borrower and lender alike, remind one of monetary value of a general election, as estimated by an amusing character in one of Hoyt's plays, Mr. Boyle D'Owl, to wit: who said that when properly conducted, there should be "something in it for everybody."

Following closely on the per diem payment is the demurrage charge; in fact, they may both be likened to branches on the same tree—they grow out of the same idea. The object is to secure the early release of cars, and the demurrage charge stimulates the activity of consignees, just as per diem is having a tonic effect on car movement among railways. Those who oppose the demurrage charge at a time when the results already obtained by per diem are so unmistakably clear that "he who runs may read," have certainly chosen an inopportune time for objection. They may, indeed, be relegated to the ranks of the men who still pursue with unflagging zeal, the perpetual motion falacy, or they may find a place among those who would still persuade us that the earth is flat. These "perpetual motioners and flat-earth men," as the late Prof. Huxley called them, along with the "demurrage-demurrers" fail to observe most obvious facts, or to discern the signs of the times. Economic conditions to-day in the car service world are such that unproductive equipment is actually very much in the way, and the per diem principal which really includes the demurrage idea, has been sought as a most welcome relief.

Railroad Trains that Waste Revenue.

A railroad president, who once was a prominent figure in the United States, followed the policy of pushing the freight trains over the system he managed in preference to passenger trains. A vigorous protest having been made against this policy, he justified himself on the grounds that he favored the traffic that brought revenue to the company. The sentiments of that railroad man were very unpopular ten years ago, but they indicated sound business views. Another prominent railroad president has lately surprised people by assuming a similar attitude concerning passenger business.

President Loree, of the Baltimore & Ohio, referring to the erection of the proposed new passenger station of that road in Washington, said: "In my opinion the passenger business is the dress parade part of the railroad business. We build fine coaches and throw them away for finer coaches; we erect mammoth sations and tear them down to erect larger stations. Every business has its display features and this is ours. I do not believe the passenger department of any railroad is self-supporting. More money is spent in these luxuries than is ever received in fares. The passenger business does not pay and never did. Every substantial enterprise has its frills and decorations, and the passenger business forms ours. I will do all I can to promote the erection of the station, for these things are necessary to show what a great railroad is, and how great it is."

That is a very sensible view, boldly expressed. The passenger department is the old man of the sea to many railroad companies, and wastes not a small part of the income earned by freight business. The sleeping car companies long ago set the pace of luxurious cars, and every years sees the ingenuity of designers racked to add something more expensive than anything produced before, and many railroad companies weakly follow that lead. This tendency of sleeping car and railroad companies to recklessness in providing luxurious trains has spoiled the traveling public, and encouraged them to demand unreasonable accommodation for which they will not pay. For years we have been hearing demands for faster trains. To meet this demand the limited expresses between New York and Chicago were accelerated from 24 to 20 hours, and it is found that the service does not pay expenses. It was expected that the conveniences resulting from the higher speed would greatly increase the travel by these trains, but this hope has not been realized. Fortunate is the railroad company that does not indulge in the luxury of "flyers," "cannon balls" and other trains of that ilk to eat up the hard-earned freight revenues.

Discipline That Hurts.

Railroad officials as a rule wish to treat their men fairly, but a great deal of injustice is inflicted on account of rules of discipline framed to inflict punishment for offences and delinquencies, without providing credit for efficient service and good behavior. If there is to be a debit account maintained against a man, there certainly ought in justice be a credit account as well. The Brown system of "discipline without suspension," has been adopted by many roads in a modified form, and in some quarters it is much more unpopular than the old style of punishment, when a man was suspended for any serious violation of rules with the understanding that the punishment condoned the offence.

The system as worked under Mr. Brown was eminently a just way to manage men, as the credits were always liable to overbalance the debits; but the people who modified the system have as a rule modified out nearly all the credits. There was a time when a petty officer would go through a division like a roaring lion, discharging men right and left for offences that were due to his own incapability. The Brown system cuts the teeth

of this kind of tyrant, but it is only half acting when it permits him to put a debit against a man without providing a system of credits. Where this is done, it is only a matter of time when sufficient debits will be recorded against first-class men to have them discharged. A half acting system of this kind has depleted some roads of their best men, many of them having resigned before their time was due for discharge. On such roads the men look back longingly to the "good old days" when a superintenden suffering from a toothache would discipline with his tongue every man who came within reach of his voice, and there the end of the castigation would be. It is easier to stand a little unjust abuse than to feel day after day that a silent record is being built up against you from trifles that will soon bring ignominious discharge.

Scarcity of Ties.

It was expected that steel as material for railroad ties would come largely into use, as the scarcity of wooden ties increased, but no entirely satisfactory steel tie has been devised, and so railroad companies are compelled to do their best with wooden ties.

The large amount of new trackage built in Northern Minnesota this season is said to have pretty well drained the tie market and the railway companies are reporting a scarcity. The tie output of last year was smaller than the preceding year for the reason that the tie men figured new railroad operations would be less expensive the preceding year. While the contracts for new lines have not been so large as in the season of 1901, there were many spur tracks built that brought the average number of miles of new track very nearly up to that of the preceding season.

The outlook is good for a large amount of new trackage to be built this winter for logging companies and some spur tracks remain to be finished to the new mines on the range, hence the demand for ties continues practically undiminished. The agents for the various concerns interested in the new trackage being built are scouring the northwest for the supply of ties they will need.

The increased demand for ties is likely to have the effect of causing heavier operations in the country this fall and winter, where tie timber is available, and it is predicted that the output of the coming season will show an increase over last. It is understood that preparations are being made on the north shore for particularly large operations in the cedar and tamarack swamps as soon as they freeze over and tie men claim the greater supply of the new ties will come from that part of Northern Minnesota.

The demand for railroad ties annually in this country is something enormous, about 100,000,000 being used every year to replace old ties and for new trackage.

Cost of Running High Speed Trains.

We believe that the Executive Committee of the American Railway Master Mechanics' Association acted wisely in relinguishing further investigation of the question, "What is the cost of running high-speed trains?" When the subject was first brought up for investigation the purpose was to ascertain the additional cost for power that resulted from the speed of a train being materially increased. A variety of tests and investigations indicated, closely enough for practical purposes, that increasing the train speed from about 30 miles an hour to 60 miles an hour doubled the expense for fuel. A variety of other extra expenses are also incurred when train speed is increased, notably repair bills, inspection, wear and tear of track, and the disturbing the movement of other trains that may be more remunerative than the fast express train. Members of the American Railway Master Mechanics' Association have found out by their investigations the extra cost incurred by the motive power department in running extremely fast trains, and that is all that they have a right to concern themselves about. The extra expense due to wear and tear of track, the loss due to demoralizing the movement of other trains and all other questions outside of the mechanical part belongs to the American Railway Association, which is composed of general managers and other operating and traffic officials. The subject is fairly well threshed out and further efforts ought to be left to the American Railway Association.

Scheming New Car and Locomotive Works.

The scarcity of motive power and cars in the country that cannot be filled up by the existing builders has induced a great many people to believe that a very good investment for capital would be in new locomotive works and in new car works. There appears to be a great many schemes of this kind on foot, and scarcely a week passes that we do not hear of an arrangement to organize a new car or locomotive building company.

If the existing prosperity could be assured for ten years there is little doubt that the building of a few new works would be paying enterprises; but this prosperity of business is like what we have experienced periodically, and a panic would be sure to bring disaster on the new concerns.

An honest man is one of the few great works that can be seen for nothing.—*—Martin Chuzzlewit.*

ENGINEERING QUESTIONS ANSWERED.

(1) J. C. F., Chicago.

Will a valve travel faster or slower when links are hooked up with locomotive going at a given rate of speed? A.—If our correspondent would use his thinking powers he could answer this question for himself. When a locomotive is running with the reverse lever in full gear the valve makes its greatest travel, say six inches. When the lever is hooked up to produce an early cut-off the travel of valve will not exceed three inches. It is obvious that when the valve travels six inches in a given time it must move faster than when it travels three inches in the same time.

(2) R. B., Philadelphia.

In reading engineering papers I sometimes find the expression "single-acting engine." Some of my friends say that a two-cylinder locomotive is single acting and that a Vauclain compound is a double-acting engine. Is that a correct definition? A.—No. A single-acting engine is one where the steam acts only on one side of the piston. In all locomotives, the compounds included, steam presses alternately on both ends of the pistons. The Westinghouse engine is a well-known single-acting engine.

(3) W. M. B., Baltimore.

When you work out the power of a locomotive you follow the well-known formula which taking 85 per cent. of the boiler pressure gives the tractive power. This method of figuring is rather deceiving, for you do not allow anything for friction, and that certainly takes away some part of the power. What ought the allowance to be? A.—We have generally allowed 10 per cent., but have reason to believe it is too low for the ordinary run of locomotives. In good stationary engine practice 7 1-2 per cent. is high for internal friction; but in making tests of a Schenectady locomotive in the Purdue experimental plant, Professor Goss found the friction to range from 12 to 23 per cent. The latter figure was found at a speed of 55 miles per hour, which showed that at that velocity nearly one quarter of the power was used in driving the motion, no allowance being made for atmospheric resistance.

(4) H. D. Havelock, Neb.

Will you kindly inform me why locomotive cylinders wear more on the top than on the bottom? A.—The wear on the top of the cylinder of which you speak, may have been caused by the guides being too low. The resultant of the upward effort of the crosshead and the horizontal motion of the piston is upward.

(5) O. B. J., Hopkins, Minn., asks

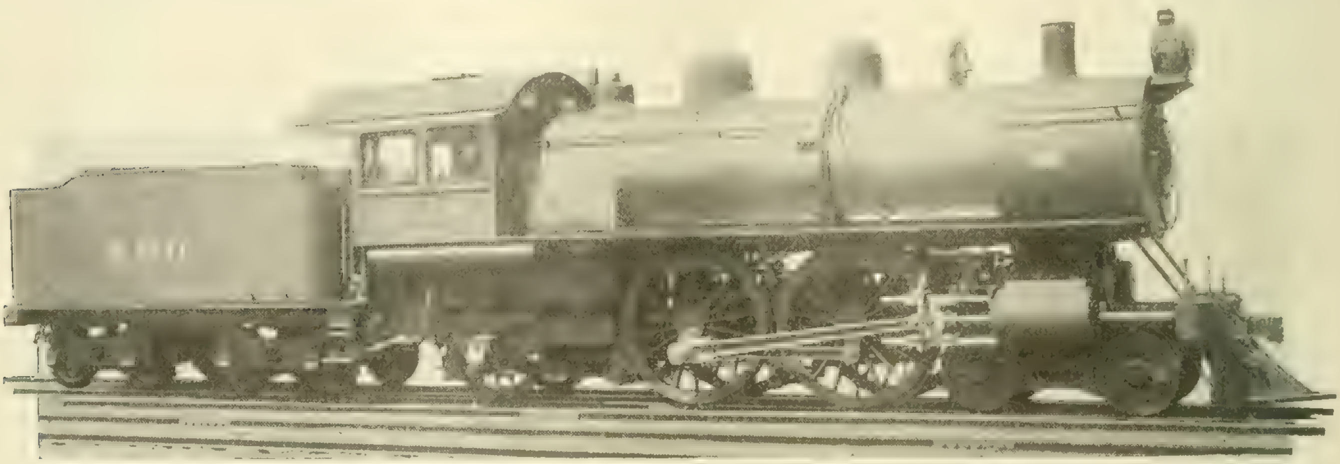
has the Davis counterbalance any advantage over the ordinary weight made in one piece? A.—1. As far as the relative merits of the Davis method of counterbalancing and that usually followed is concerned, both systems have strong supporters, and the question is as yet not fully determined. 2. Are locomotives ever built with cylinders in line with driving axles? A.—Yes. When the cylinders are set at an angle it is usually to facilitate placing of some part of the machine, such as engine truck wheels, in former days. No mechanical advantage is gained by placing cylinders at an angle. 3. Why is the front end of the parallel rod on some moguls made with strap, gib and key, while the rest have only bushings? A.—It is usually done for economy of space, the bushed ends of the rod require a plate and nut on the outside of the pin, and in the case of the front pair of wheels, these would be likely to interfere with the guides and crosshead.

(6) B. H., Scranton, Pa.

When railroad men talk about curves they nearly always refer to them as so many degrees curvature. Can you give me a rule of how to work out the curvature by degrees? I have been accustomed to thinking of curves as part of a circle of a certain radius. A.—Surveyors measure curves as part of a circle, whose radius is established by the angle of deflection. If the angle of deflection is 1° the radius of the curve will be 5,730 feet; 2° is half as much, and so on. A 10° curve will be part of a circle having 573 feet radius. If you keep in mind that 1° is a section of a circle with 5,730 feet radius you will always be able to tell mentally the radius when you hear the number of degrees mentioned.

(7) B. S. R., Hornellsville, N. Y.

I wish to ask what produces that terrible sound in the firebox of the small type of engines, such as the small footboard with a small firebox. It sounds as if it would take the top of your head off, something similar to a safety-valve. Some claim it is a hole in the fire, which I know is untrue, as I have carefully examined the fire and the engine steams fine; of course, the fire is light and level. Now there is certainly some great change taking place to cause such a sound, whether there is a hole in the fire or not. I would like to have some of my brother railroad men or chemists tell me what produces this sound. A.—The sound is produced by a series of rapid explosions caused by the hydrogen in the coal combining with the oxygen that sustains combustion. The roaring occurs only when the mixture of gases is exactly right to produce it. We have generally found that the mixture was most likely to be right when an engine stood on a bridge or trestle, but it sometimes happens on the ordinary track.



MADE WONDERFUL RECORD OF POWER AND SPEED.

A Fast Run on the M. C. R. R.

A fast run was recently made on the Canada Southern division of the Michigan Central Railroad which is worthy of notice. A 4-4-2 type engine similar to the one shown in our illustration hauled sixteen passenger coaches from Bridgeburg to St. Thomas, Ont., a distance of 118.22 miles, in 127 minutes. The weight behind the tender was 605 1-2 tons, while the engine and tender together weighed 125 1-2 tons. A total load of 731 tons was, therefore, moved from one terminal to the other against eight slowdowns at a steady average rate of 55.8 miles an hour. The machine was built at the Schenectady shops of the American Locomotive Company, and has 21x26 in. cylinders, 79 in. drivers, 50 3-10 sq. ft. of grate area and 3,521 sq. ft. of heating service. This exceptional performance was, no doubt, rendered possible by the liberal heating surface provided.

Pounding of Piston Valves.

A matter in connection with piston valve locomotives which is of interest and which has prompted some inquiry, is the pounding and consequent development of lost motion in the valve gear. This pounding is peculiar to the solid inside admission type of piston valve, and results from the pressure of the exhaust steam which, passing up over the ends of the valve exerts a force sufficiently great to take up the lost motion in the valve gear with a jerk or pound, more or less, according to how the engine is being worked. The exhaust pressure it will be understood operates to move the valve in the direction in which it is traveling at the time. The lost motion in the valve gear being taken up by the effort of moving the valve, it is consequently free to be forced ahead the distance which the lost motion in the connections will allow. In the case of an engine considerably worn and being worked slow and in long cut off this pounding is excessive and results in rapid wear and increase of lost motion. This action soon becomes severe enough to crystallize and break valve stems and other parts. It also causes a certain irregularity in the admission of steam, since the valve jumps and then stops until the lost motion is taken up. This effect is perhaps not important, but the pounding is so detrimental to the gear as to probably preclude the use of solid piston valves, when the matter comes to be thoroughly understood.

P. M. FOSTER.

Collinwood.

In 1890 the railroads in the United States carried 80,000,000 tons of freight one mile and were paid a fraction over nine-tenths of a cent for carrying each ton one mile; in 1900 they carried 140,000,000 tons of freight one mile at a rate of seven and a half tenths of one cent per mile. That rate is pretty near cost, and it is not expected that rates will be made lower in view of the additional expenses which railroad companies must now meet through the advancing rates of wages.

Air-Brake Department.

CONDUCTED BY F. M. NELLIS.

Air-Brake Instruction Rooms at Trenton, N. J.

Two views of the handsome air-brake instruction rooms of the railroad branch of the Y. M. C. A. at Trenton, N. J., are illustrated herewith.

A VIEW OF THE PENNA. R. R. INSTRUCTION ROOM AT TRENTON, N. J

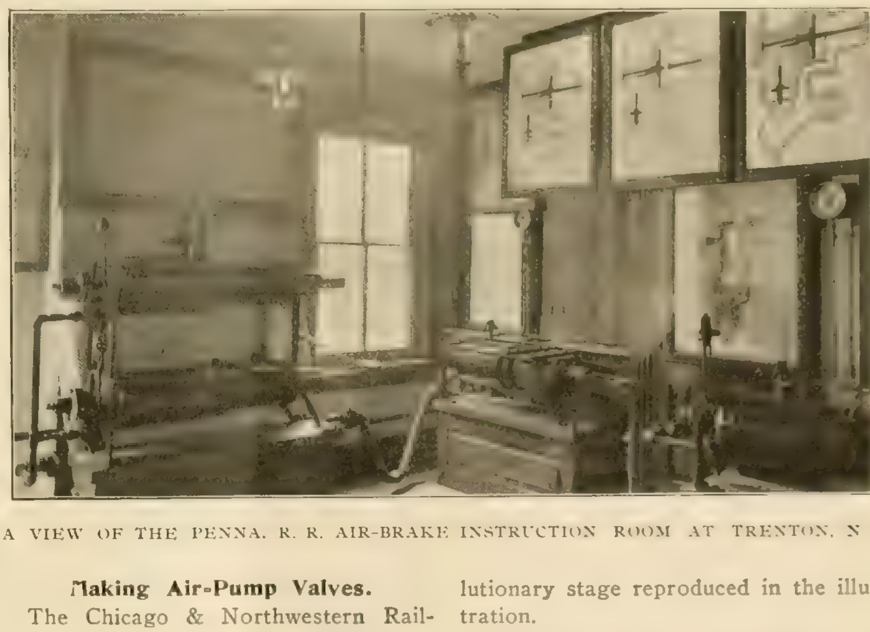
As will be noted, the two illustrations show an excellent arrangement of the equipment, which was designed and installed by W. B. Page, master mechanic of the Lambertville shops. Regular classes are held in these rooms, at regular intervals during the week, when air-brake instructions are given. The rooms are open at any time to any and all of the railroad men who may wish to visit them and operate the apparatus with a view of acquiring fuller knowledge of the air-brake art.

This is an excellent example set by the Pennsylvania Railroad, and is worthy of being followed by all other railroads that would have their employees profitably entertained and properly instructed in up-to-date air-brake information.

Antiquated Methods of Testing Air Brakes.

It seems rather pathetic nowadays when a leading railroad reports that the air brakes on a fast freight train must wait for test until the locomotive is backed down from the shops and coupled to the train, and when a full hour is consumed in the testing. Yet this is the situation on some of the railroads which otherwise have a claim to greatness. The time of testing will be largely reduced if the yards are equipped with testing plants where an important train may be tested while it is being made up, or immediately after, thus doing away with the necessity of waiting for the engine and consuming valuable time after the crews have been called and are ready to start.

This old-time method, which should be immediately regulated as exceedingly costly and behind the times, should be replaced by a more modern one of yard testing plant, which will greatly falicitate the air-brake service.



A VIEW OF THE PENNA. R. R. AIR-BRAKE INSTRUCTION ROOM AT TRENTON, N. J.

Making Air-Pump Valves.

The Chicago & Northwestern Railway have succeeded in making the valves used in their Westinghouse air pumps, and of making them very satisfactorily and very cheaply. A bar of 7-8-machine steel, about 11 in. long, is heated, and one end is thrust into the jaws of a forging machine. The jaws grip the bar, while the dies closing from each side squeeze the metal into the form of a cross, as shown by the first stage, in our illustration. The other end of the bar is then similarly treated, and the first operation is completed by the formation of the wings.

The second stage in the manufacturing of these valves consists in the formation of the valve-seat. This is done by pushing the bar into an end die, which is cut out to receive the wings. The operator does this easily enough, as the cross-shaped end is held so that two arms are vertical and two horizontal. Two side moving jaws grip the bar, and the end motion of the forming die upsets that portion of the bar just beyond the wings. The wings, being sunk in the cross-shaped cavity of this die, suffer no alteration in form, while perhaps about 1 1-4 in. of metal is upset to form the collar, which ultimately makes the valve face. At the same time, the collar thus formed is pressed over projections in the die, so that when withdrawn from the machine, the cavity between each wing, under the newly-formed collar, is smoothly and definitely formed. The bars with these "rudimentary" valves on the ends are sheared in the middle, and the valves then appear as shown in the second evolutionary stage reproduced in the illustration.

The third stage is completed very quickly in a turret lathe. The shank ends are held in the jaws of the chuck, and the ends of the wings are cut off, their sides trued up, the bevel valve face is formed, and the valve is cut off; the whole thing being done in four successive operations conducted very rap-

idly. The shank which remains is subsequently threaded to make a stud, or if desired it can be left long enough to stand heading, and is then turned out as a well-made bolt. Nothing is lost in the manufacture of these valves, and it is needless to say that the cost of production has been compressed to as desirable a form as that of the metal bar when it leaves the forging machine at the end of the second stage.

Arrangement on Engine of High-Speed Brake Parts.

The engine truck brake, which made its appearance on locomotives shortly after a very serious accident on one of the railroads in the New England States some years ago, and prior to introduction of high-speed brake, has been used in train service to a greater or less degree ever since. The arrangement of the parts has been in several ways, without much regard to standardization. Following are a number of the arrangements of piping and location of high-speed brake parts, as used on some of our leading railroads.

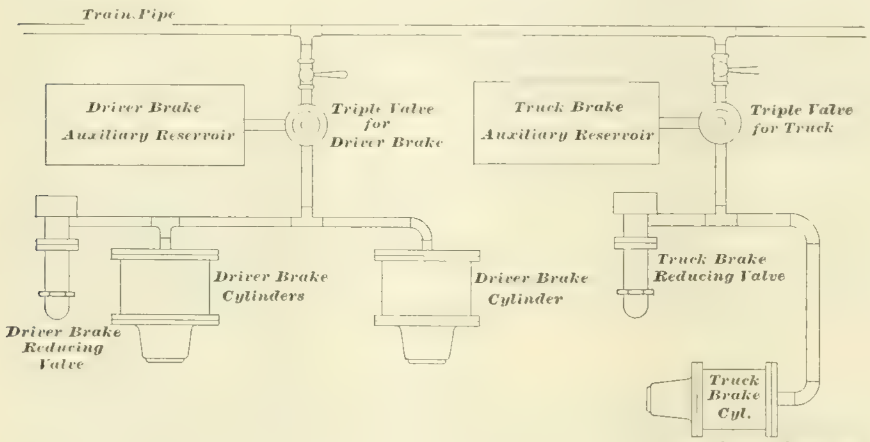


FIG. 3.

Fig. 1 shows an arrangement where one auxiliary reservoir is employed to supply the two-driver brake cylinders and the one-truck brake cylinder. In this arrangement the truck brake may be cut out without cutting out the driver-brake cylinders; but the entire auxiliary reservoir capacity is retained for the driver-brake cylinders, thus jeopardizing the driving-brake wheels by sliding. If either of the driver-brake cylinders become defective and must be cut out, the tender brake must be cut out, and thereby sacrificed, as well. The cutting out is done with the cut-out cock in the branch pipe between the main train pipe and the triple valve.

Fig. 2 shows a modification of arrangement illustrated in Fig. 1, a cut-out cock being placed in the pipe leading to the driver-brake cylinders. With this arrangement either the driver-brake cylinders or truck-brake cylinder may be cut out; if either becomes defective, thus evading the necessity for throwing the entire auxiliary reservoir capacity into the truck brake or driver brake, should either brake become defective or fail.

Fig. 3 illustrates an arrangement of the parts wherein the driver-brake parts are separate and distinct from the truck-brake parts, both brakes being connected to the main train pipe. In this arrangement, either the truck brake or the driver brake may be cut out should either become defective, and the remaining brake would act efficiently and would not be dependent upon or related to the other brake in any way. This arrangement, however, calls for the provision of a triple valve for the truck brake and one for the driver brake.

Fig. 4 shows an arrangement where the two auxiliary reservoirs and one triple valve are used for both the engine truck brakes and the driver brakes. This arrangement, however, is also faulty, inasmuch that if the driver brake were to become defective, the truck brake would also have to be cut out.

Fig. 5 shows a modification of the arrangement illustrated in Fig. 4, making that arrangement entirely satisfactory. In Fig. 5, as in Fig. 4, the auxiliaries for the driver brake and tender brake, respectively, are located in tandem fashion underneath the running board, which makes a very satisfactory arrangement. In Fig. 5, the cut-out cocks are so arranged that either the driver brake or truck brake may be cut out should they become defective without disturbing the other brake. This is considered one of the best arrangements of parts for the high-speed brakes on locomotives.

Fig. 6 shows a general arrangement of the parts, somewhat similar to Fig. 5, but in such a way that the auxiliary reservoirs can be arranged otherwise than in tandem fashion under the foot board. In this figure, as in Fig. 5, the truck brake may be cut out at will without disturbing the other brake. This arrangement, as does also Fig. 5, permits of results as effective as does Fig. 3, where two triple valves are employed.

Figs. 1, 2 and 4 may be summed up as distinctly faulty. Fig. 3, while being correct and effective, employs necessarily a second triple valve for the truck brake. Figs. 5 and 6 may be accepted as illustrating perfectly satisfactory and good recommended practice.

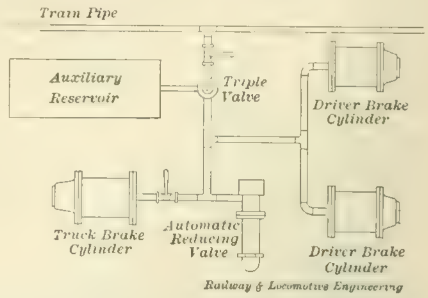


FIG. 1.

MORE DESOE CHARTS.

Beginning with our February number we shall publish in serial form a color scheme of showing pressures of the air brake system under different conditions. This will include operations of the freight brake, passenger brake and high speed brake. These serials will be by E. G. Desoe, the originator of colored illustrations of the air brake system, and will doubtless prove the results of his best efforts. Be sure to get all these numbers.

CORRESPONDENCE.

Emergency Tests of Air Brakes.

I wish to say a few words in reply to Mr. Desoe on trains being made up in the yard and before the engine arrives. We know it is a fact that we cannot make up trains fast enough—business is too good; and to hold a freight train of 50 cars in a yard to make a service application of the brakes, then recharge and make an emergency application of the brakes is preposterous.

For illustration, say, we take away the service application of the brakes entirely from yard test, and make none other than the emergency test. Then what about your leaky packing leathers not being detected? What about brakes going into emergency with service application, broken graduating pins, sticky triples, excess strain on the brake rigging, etc.?

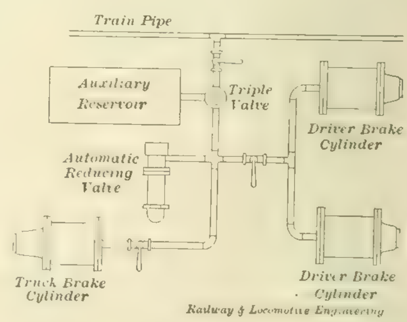


FIG. 2.

Again, where freight yards are located on a grade like the Nashville yards, it is necessary to have at least from 8 to 10

hand brakes set to hold the train. We experience quite a good deal of trouble when the triples work emergency in service, and hand brake set that the push rod will knock a hole through the center of the brake cylinder piston. It is bad enough to apply brakes in emergency on the line of road to avoid accident. The emergency feature of the air brake was intended for emergency cases only on the road, and not to knock things to pieces in making unnecessary and senseless tests.

In reply to his article in December number, is it not a fact that the emergency test of air brakes at a terminal point will not altogether say if angle cock is partly closed or not?

Secondly, I still hold that the foundation brake gear is strong enough for service tests, but if we are going into the high-speed brake let us increase the strength of the foundation brake gear. But that is another question and is out of line. The Westinghouse bulletin No. 10 says that the standard brake gear is of ample strength for the high-speed brake. This has nothing to do with trying brakes in emergency at terminal point. We are not testing brakes in emergency to see how strong the levers and rods are. The extra stress is not put on the brake rigging until train is in motion.

Thirdly, I still maintain that it is not necessary for an angle cock to be wide open to get quick action. Now, I would like to have our brother Desoe explain if he has a 50-car train and goes up to the engine and tells the engineman to apply the brake in emergency, how can he tell if an angle cock is partly closed between the 20th and 21st car; how can he tell if the brake worked in emergency on the 21st car up to the 50th car? In my opinion, it would be well to equip brother Desoe with wings (a very ordinary kind, of course—marked down from a dollar), or that it would be well for brother Desoe to equip all inspectors with an ear trumpet or long-distance telephones.

Now, of course, all angle cocks should be open and let the inspectors know they are open. Seeing is believing. In making up our trains in Nashville yards the test plant hose is attached to the rear end, and each hose is blown out before being coupled.

Otto Best,
A.-B. Inspector N. C. & St. Louis Ry.
Nashville, Tenn.

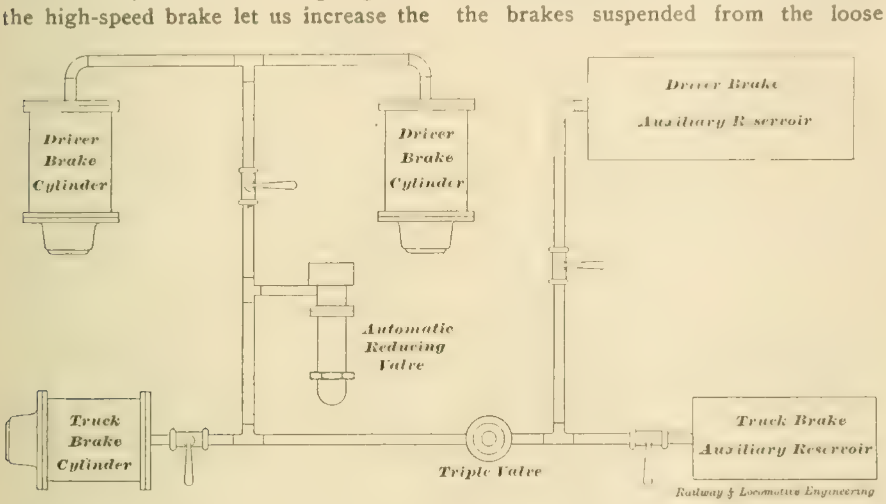


FIG. 6.

Some Foundation Brake History.

During the early and middle '70s, the Wharton switch was used extensively on the Pennsylvania Railroad and elsewhere.

While possessing many merits, the fact of its rails rising to a height of several inches above those of the main track caused many brake riggings to be caught and torn from the trucks. Of course, this trouble only occurred with trucks having the brakes suspended from the loose transom, and then only when the springs became weak or were unduly depressed from any cause.

The Pennsylvania Railroad cars, and those of many other companies passing over its lines, were equipped with diamond trucks having inside brakes suspended from the loose transoms; and these transoms were carried either upon half-elliptic springs, or some type of the large family of spirals which, after a few trips, refused to rise from the point to which the loads had compressed them.

The result was that not only were many such brakes torn off on the high switch rails referred to, but derailments and much damage often followed such tearing off of brakes.

The P. R. R. Co.'s attention was first called to it by the frequency of such occurrences under engine tenders fitted with diamond trucks using wheels of 28-in. and 30-in. diameter.

Mr. Elder, of the Altoona shops, was the first to attempt a remedy. He designed a brake in which the lower holes of the levers were attached to the jaws in the break-beams, and the holes usually so attached were thus thrown higher up and were secured to jaws which swung upon castings bolted rigidly to the spring plank. These jaws were provided with a number of holes to permit adjustment. The levers, when the brake was not applied, stood away from the transom at their top ends, and the lever more distant from the point where braking power was applied was provident at its top with a sheave about 5-in. in diameter and placed horizontally in a frame or case forged on the top of the lever. Around this pulley the chain operating the brake was carried and connected at its end to the top of the plain lever. Thus, when power was applied the two levers were drawn together and the brake set.

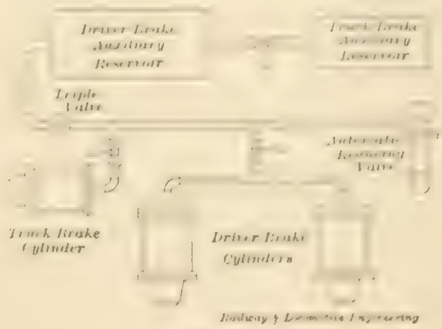


FIG. 4

Upon the adoption of switches having rails conforming to the rest of the track in height, this brake passed out of use, although within a twelvemonth the writer has seen several yet in service on P. R. R. cars.

Soon after this type of brake was designed, Messrs. W. C. Allison & Co., of Philadelphia, Pa., patented a wrought iron device to be attached to the lower (rigid) transom of diamond trucks in such a manner as to permit the brakes to be hung upon these devices, and thus enable the standard levers and connecting bars to be used without danger of being torn away, as when suspended from the loose transom.

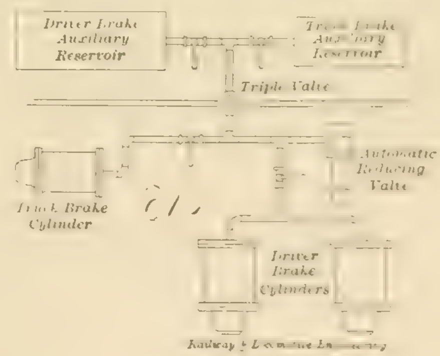
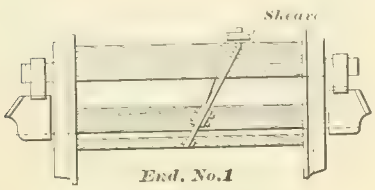


FIG. 5.

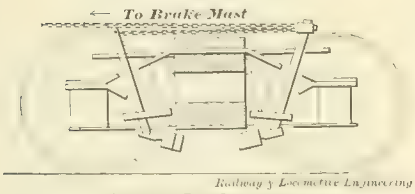
This device fully proved its inventors' claims, and while it was thenceforth largely used, the Pennsylvania people appeared satisfied with the Elder brake; and the coal company, of whose large car equipment the writer had charge, after applying a number of the Allison suspension stands, adopted a substitute pre-

pared by one of its employees; and as this substitute was formed of two vertical pieces placed on opposite sides of the transom and held together by three bolts, we thenceforth had no end of trouble owing to persistent refusal of the parts of this "improvement" to remain firmly in place for any length of time.

A competing company used the Alli-



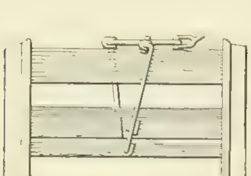
End. No.1

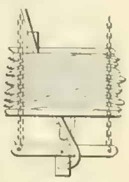


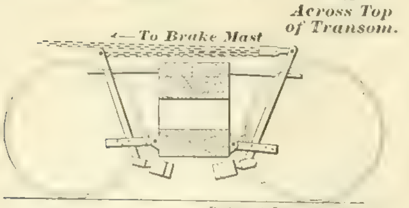
Elder's Brake. (No.1)

son device with entire satisfaction for years, but with that odd tendency of human nature not to "let well enough alone," superimposed upon this "good thing" a device originated by an employee, which had to a marked degree the merit of simplicity, but was not productive of the results usually attributed to that virtue.

This device consisted of a plain standard brake lever attached at its lower end to the usual jaw in the brake-beam, and at its top to the chain or rod applying the power; while to a hole a few inches above the point of attachment to the brake-beam was bolted one end of a connecting rod, which at once curved upward and passed over the top of the lower transom, and then curved down-


End. No.3


No.3 Across Top of Transom.

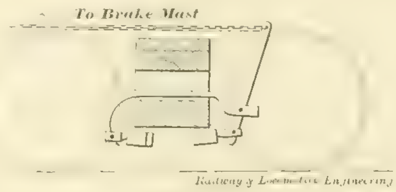


No.3

ward and was secured rigidly to the other brake-beam and at its lever end was provided with a number of holes for adjusting.

Our company next came to the front with a brake designed by the inventor of the "rival" to the Allison stand. This brake closely followed the lines of the Elder brake, except that the sheave was replaced by a short lever placed horizontally and in line with the transoms. The center of this lever was attached to the top of the brake lever, most distant from direction of applied power, one end to the brake chain, and the other end, by means of a rod passing over the top of the loose transom, to the remaining lever.

Another "inventor" was permitted by our superintendent to apply a brake of his design to one of our cars. Having unfortunately preserved no drawing of this brake, I am not certain as to all its details; but recall its chief features consisted of two levers of standard type, but much shorter, attached to the brake-beams and to the lower transoms after the manner of the Elder brake. These, at their tops, were united by a set of adjustable connections terminating in a floating lever placed on the side of truck nearest to the source of application of power. The brake chain was attached



No.2

to this lever and therefore avoided the use of long chains which were on the preceding two.

Last (but not least in general worthlessness, perhaps), came a device of the writer, whose youthful ambition did not for an instant propose that all these people should "make brakes" and leave him out in the cold. Modesty (!) for-

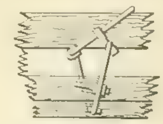

Side. End. Allison's Support. Single Piece. No.6

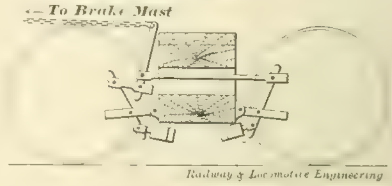
End. 2 Pieces. Support. No.7

bids farther description than to say that it differed from the Elder brake only in using standard levers, and placing the sheave in a semicircular shield, having upon the outside a clevis attached at its duplex end to the bolt or pin forming the axle of the sheave; and at its single end to a chain or rod uniting it to the brake lever. The brake chain then passed around the sheave and was attached to the other lever; the sheave standing when in release position, about in line with the side of the transom opposite to the lever to which it was directly attached.

The refusal of the P. R. R. inspector to allow the cars fitted with the second type described, to go upon the road, and a decided preference of the writer for the old standard brakes, caused some warmth of feeling between him and a high official of our company, and led to a practical test of their merits. This test was made upon a lateral track leading to one of the mines, having a grade somewhat exceeding 150 feet to the mile, and being nearly one mile in length.

The test train was composed of six


End. No.4



No.4

8-wheel coal cars, having an average light weight of 20,000 pounds each, and containing an average load of 24,000 pounds each.

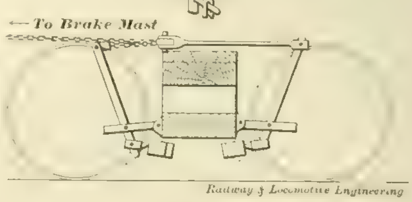
They were arranged in the following order: First, a car with brakes of standard type; second, two cars with brakes of the third type described; third, one car with brake of the second type described; fourth, a car having brake of the fourth type, and last the car with my own design.

Precaution was taken to place a number of empty cars at the foot of the hill to act, if necessary, as a "buffer" and prevent the unexpected advent of the "Special" upon the main line.

Crew and passengers, to the number of ten, boarded the cars, and we started, by releasing the standard brakes. Although each truck was braked independently, we soon found it impossible to stop the train when all the "improveds" were set, and the momentum rather increased than diminished. The standards were then brought into use and worked effectively until a chain of one of them gave way.

The speed was then about ten miles per hour, and the advocates of improvement lost interest in the test, and despite our remonstrance began jumping off, in their inexperience performing


Across Transom. No.5



No.5

gyrations as they reached the ground which would turn a gymnast green with envy; but fortunately escaping other in-

jury than somewhat soiled and torn garments!

Three of us finished the trip in triumph with a bump against the empties, our speed having been considerably reduced by a judicious use of the remaining efficient standard brake and the aid of a sharp curve and easier grade at the bottom; but in the hot summer afternoon we emerged from the cloud of coal dust resulting from the blow with our faces and hands as black as Africans.

The officer referred to said we might restore the standards, but keep the improved parts carefully until called for!

Although I remained in the service of that company several years afterward, the "call" never came.

C. H. CARUTHERS.

Yeadon, Pa.

QUESTIONS AND ANSWERS

On Air-Brake Subjects.

(1) B. M. McC., Louisville, Ky., asks:

Isn't the left head in the main valve bushing of a 9 1-2-in. pump to protect by cushion the piston 79? Is it for any other purpose, and can the pump be run without such cushion? A.—The head referred to receives the small main valve piston, is its cylinder, and guides the main valve in its operation. Its head is so constructed that the piston is cushioned on its extreme traverse to the left, and the pump could not be run smoothly without this cushion. This arrangement of the parts is made for convenience to get at the parts for repair work.

(2) B. M. McC., Louisville, Ky., asks:

If a discharge valve in a 9 1-2 pump broke, would you not get better results if you put the receiving valve in its place? A.—You would not get good results in either case. If the discharge valve were broken and the receiving valve were whole, the main reservoir pressure would flow back into the pump each time on the return stroke. If the receiving valve were broken, the piston would push the air pressure out through the broken valve each time on the return stroke, instead of compressing it past the receiving valve into the main reservoir.

(3) S. W. B., Buffalo, N. Y., asks:

Do you believe that a hose that will not burst when 150 pounds of air is put on it is a first-class hose, and if it will stand this pressure, would you consider it all right for service? A.—The bursting test is not the only test required of a good, high-grade, air-brake hose. The master car builders' specifications require that a hose when first manufactured must be able to withstand a pressure of 500 pounds before bursting. Each hose must stand, in addition to this, a shop test of 200 pounds. One of the greatest essentials in an air-brake hose is its ability to bend readily and be flexible. The hose should also have sufficient good quality of rubber in its composition, and not too much duck. It will be seen that several layers of duck and low grade rubber would make a hose that would withstand a high bursting pressure, but would not be flexible enough to bend and accommodate itself to the curving that would be necessary in practice. We would not, therefore, consider an air-brake hose that stood a pressure of 150 pounds alone to be a high-grade hose.

(4) J. F. McG., Corbin, Ky., writes:

It has been positively stated that it is utterly impossible for the New York triple to go into quick action after 5 or 6 pounds has been drawn off the train pipe in service application, yet in our instruction car I have seen 5, 10 and 15 pounds reduced in service, and the emergency application gotten by placing the handle in emergency position. How would you account for this strange action? A.—It would seem from your letter that the train pipe in the case mentioned has been overcharged after an application. In other words, after a train pipe reduction has been made, the brake has been released, train pipe recharged heavily (but not auxiliary), and the brake applied again. In this event it would be possible to reduce 5, 10 or 20 pounds in a service position, and get the emergency action immediately following such service reduction.

(5) J. L. E., Hagerstown, Md., writes:

Don't you think quite a lot of the break-in-twos that are blamed on the air brake ought to be traced to bad knuckles and poor draft gear? A great many times a train breaks in two and the conductor reports that the air brakes broke a train in two and broke a knuckle or pulled out a draw-bar. Don't you think the draw-bar or the knuckle was really to blame and not the air brake? A.—Undoubtedly a great many break-in-twos are wrongly blamed on the air brake as you mention, and if properly investigated at the time could be traced to a defective knuckle or coupler. However, both knuckles and draft gear on cars are being improved and less trouble may be expected on this score. Nearly all heavy modern 100,000 pound capacity cars are equipped with friction draft gear and strong knuckles in the couplers.

(6) J. A. D., Albany, N. Y., writes:

Why is it that slid flat wheels are about as common in the autumn of the year as in the winter time? I have noticed that in the spring of the year there is very little trouble experienced from sliding of wheels. Why is it that they do not slide as much in springtime as fall? A.—One of the greatest causes for wheels slinding during the autumn season is on account of autumn leaves getting on the rails, therefore causing the wheels to slip and slide. One instance was recently called to our attention where a heavy ten-wheel locomotive was unable to make time with a train of three coaches on a road running through a wooded country, and where large numbers of dead leaves fell on the tracks. It will be observed in flat wheel seasons that the locomotive drivers slip a great deal more than in other seasons. In the case just mentioned the dead leaves interfered with the adhesion between driving wheels and rails, causing the engine to slip, in the same way that they destroyed the adhesion between the car wheels and rails, causing the brake to pick up the wheels and slide them.

(7) D. L. F., Topeka, Kan., writes:

I have an engine with a 9 1-2-inch pump and a D-5 brake valve. I set the brakes, then release, place handle in running position, and the brakes set again quickly. The feed valve has a leak at its bottom and a very slight leak out of the emergency exhaust port. These leaks are felt in both running and release positions. There is a pipe leading from the brake cylinder up into the cab to help release brakes. You can feel the air accumulating constantly, and if the pipe is shut off a while, the pressure is very strong. I do not know what sets the brakes. After releasing the connections are all tight and there are no leaks in the brake cylinder. I claim that the air coming from the brake cylinder is from a leaky triple and that the brake valve has nothing to do with this accumulation; but it's a fact that no air accumulates in the brake cylinder until the valve is placed in running position. The excess pressure is maintained all right. The main reservoir pressure is governed in this valve. Please give me some light on this subject. A.—You have probably left your brake valve handle in release position too long, and thereby permitted more pressure to pass from the main reservoir through release position direct into the train pipe than your feed valve is set for. When you bring your handle to running position you cut off your direct communication between the main reservoir and train line. Your train line is now higher than the feed valve attachment is set for, and there is a leakage of train pipe pressure through your feed valve attachment to the atmosphere, presumably through a crocked diaphragm or bad joint in your feed valve attachment, and possibly from other numerous small leaks elsewhere in the train pipe. The train pipe pressure will therefore reduce, and not being reinforced with main reservoir pressure by your feed valve attachment, your brake will set. You can prove this by pumping up your pressure with the brake valve handle in running position and not placing it at all in full release. Another proof is to release brakes in running position, carefully keeping out of full release. Try this. We think it will end your trouble.

Marvelous Achievements of One Century of the Locomotive.

BY HARRIS TABOR.

The closing years of the 19th century will go on record as the most marvelous in the history of the world. Even the birth of the steam engine did not exert so great an influence on the world's industries as have the improvements of the past decade. Within that time the most stupendous aggregations of capital and combinations of industries have taken place and developments of a most important nature have been the rule. Railroads, which ten years ago were handicapped for the want of freight, have since practically renewed their rails, rolling stock equipment and bridges to enable them to handle the enormous traffic now offered. Notwithstanding all these changes, there is not an important line of rails in this country that is not restricted by a scarcity of rolling equipment that amounts to positive famine. Locomotives have had their tractive power doubled and the 10-ton and 20-ton cars of a few years ago have given way to the more modern cars of 30 and 50 tons capacity. To suit these conditions heavier rails and bridges have been called for and supplied.

It is the day of big things. Stationary steam engines, gas engines, machine tools and structural work have taken on dimensions and tonnage undreamed of 20 years ago. Old methods have been thrown aside and forgotten, and the new have been as thoroughly assimilated as though they were the product and growth of centuries instead of a few years.

The majority of your readers will remember the then mammoth Corliss Centennial steam engine of about 25 years ago, with a maximum of 2,500 horse power. Probably no exhibit in the Philadelphia Exposition drew the attention and admiration that was given this machine. After the exposition was over Mr. Corliss sold this engine to the Pullman Car Company, Chicago—then one of the largest plants of the kind in this country—to be used as a general power supply for the shops. As a matter of fact, this engine was so much too large for the duty put upon it that, when carrying its full load, the steam gages on the boilers often showed no apparent pressure; the whole work being done, as shown by indicator diagrams, with steam below atmospheric pressure and with a mean effective pressure in the cylinders of 8 pounds. It would be interesting to know just how deficient in power that this famous engine would be in the Pullman plant to-day.

In steamships no less significant changes have taken place and are still being made. The fast ship of ten years ago is a laggard in the ocean race of to-day, as your editor, who makes annual trips to the heather blossoms, knows. When the Oceanic and the big German liners spread their pennants Froude's ideal length for speed, 700 feet, was reached, and we supposed the commercial speed limit was also attained. Now we get the astonishing announcement from the old Cunard Company that they will build two new ships with a speed of 25 knots per hour, a speed surpassing our best railway passenger service when we, who have passed the middle mark in life, were born.

In steam engines improvements and growth to bigger dimensions have been no less remarkable. A single shaft in a modern steamship will often transmit from its engine to the screw from four to six times the power developed by the Centennial Corliss engine; and, more remarkable still, these ships will keep up a continuous run for 3,000 miles. In stationary engine practice units of steam power have been multiplied three and four times beyond that of the Corliss mammoth, and we have numerous builders who are ready to supply such machines. Steam turbines, a product of the last years of the 19th century, are also taking on great dimensions and bid fair to rival the reciprocating engine in economy. In gas engines we find four units have increased within ten years, from 50 to 1,000, and makers to-day are as ready to supply the larger size as they were formerly the smaller. With all these improvements in the way of greater dimensions and tonnage have come better designs and workmanship.

HARRIS TABOR,
ENGINEER.

This wonderful industrial growth has been made possible only by the men who furnish the means to do it with. To understand this one must go to the machine tool builders, the foundry, the forge and the rolling mill, where he will find the tense energy and determination to meet all demands that characterizes this nation. These sources of supply have grown with the industries depending on them, and to-day are catering to the markets of the world.

We can imagine nothing that will illustrate the recent industrial growth of this country more briefly and eloquently than the sky line of New York City. The modern buildings from 16 to 30 stories high—monuments to daring and enterprise—standing by the side of the dwarfed products of a few years ago, tell the story at a glance. All the architecture may not appeal to us and we may smile at Mark Twain's simile of a "mouth full of jagged teeth," but we must admit that this line against a clear sky is a record of marvelous work.

Conventions Go to Mackinac Island.

The joint committee of the Master Car Builders' and the Master Mechanics' associations met at Buffalo on December 10 and arranged for the meeting place of the next conventions. Mr. J. W. Marden, Boston & Maine, was chosen chairman. A sub-committee appointed some time ago reported in favor of Manhattan Beach, but when the full committee met they decided to listen to persons representing other places before they made a final decision. Hotel men from Mackinac, Colorado Springs, Denver, Atlantic City, Put-in-Bay and Niagara Falls were permitted to describe the attractions of their various localities and of the comforts offered by the hotel-keepers. After the offers made by the various places had been weighed a vote was taken, which resulted in favor of Mackinac. The Master Mechanics' convention will come first and will begin on June 17. The convention headquarters will be at the Grand Hotel, Mackinac Island, and the rates will not differ much from those usually charged. Applications for rooms should be made to Mr. Henry Weaver, Planters' Hotel, St. Louis, Mo. Applications for space to exhibit in, should be made to Mr. J. Alexander Brown, 24 Park place, New York.

About 4,500 miles of railroad are now in operation in Japan, and of this 35 per cent. is operated by the government, while all of it is more or less under government regulation, a special department of the government being maintained for that purpose. The roads in Japan are all narrow gauge, the standard there, being three feet. The building of locomotives has only been attempted in the country in a very small way, but all of the cars, both freight and passenger, are built in their own shops, some parts, such as the wheels, being imported.

Recent Development of Block and Interlocking Signal System.

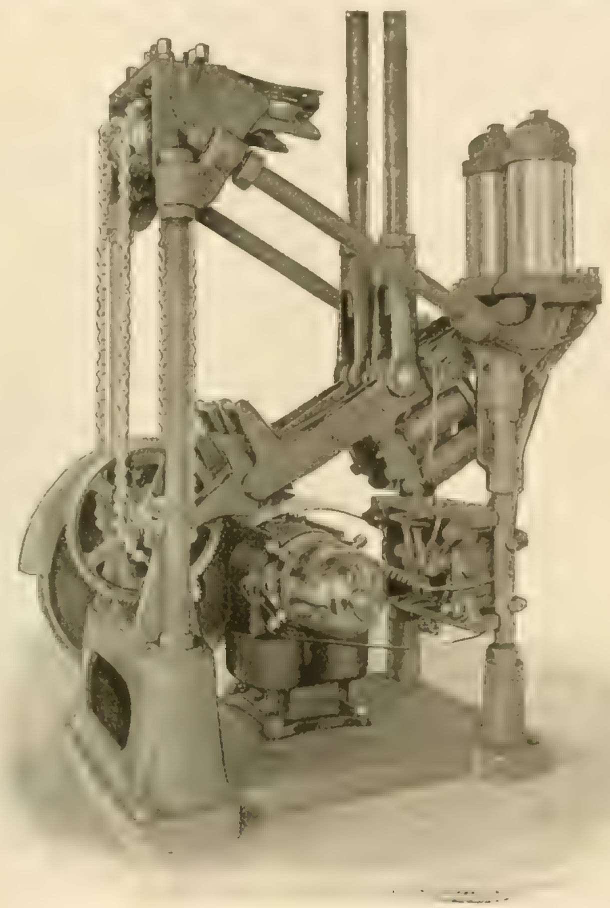
BY W. H. ELLIOTT, SIGNAL ENGINEER, C., M. & ST. P. RY.

In judging of the development of any signal system, it is necessary to consider the subject from the standpoint of the trainmen or operating official and from the standpoint of the signal engineer who is charged with the successful maintenance and working of the signal apparatus. From an operating standpoint there has been but little change or improvement in the older signal systems and the newer systems conform to the practice followed in those already in use. What is of the most value to operating men is that block signal systems and interlockings have been very widely introduced and are in use in one form or another on almost all the principal lines in this country. With a great increase in the number of trains something more than dispatchers' orders are necessary to insure the safe running of trains, and some kind of a block signal system is an absolute necessity. With the increase in the speed of trains, due to competition and to the demands of the public, all unnecessary stops must be cut out, and in order to accomplish this, interlockings have been put in to make the running of crossings, junction points and draw bridges safe.

No one improvement in signaling has been of more importance to trainmen than that of using green for the all clear night indication, and while this practice has been in use on the C. & N.-W. Ry. for a number of years, it is only of late that many roads have made the change from white to green. The perfecting of a special shade of yellow glass, which will answer for the cautionary indication, simplifies the situation very much and it is expected that many roads will change to green for the all clear night indication with red for the stop and yellow for the cautionary indication. The use of green has much to commend it, as with white meaning "Clear," any light in line with a signal may be taken for the signal light and an accident result. That there is great danger of this happening cannot be denied, owing to the intensity and increase in the number of arc lights that are used in cities and small towns. With white for the all clear indication, a broken glass will result in the clear indication being given, although the signal may be in the stop position, and a derail open. With the glasses in the semaphore breaking occasionally and with the many that are broken out maliciously by tramps and boys, it is surprising that so few accidents really happen from this cause. Perhaps all that do happen are not reported in the railroad journals.

The yellow light for the cautionary indication seems to be more satisfactory than the combination of red and green, which is in use on many roads. The single light is more easily discernible than are the two lights and is less likely to be mistaken for two separate lights in line with each other. Sometimes one light or the other of the two light combination does not show, and an incorrect indication is given. The yellow light, if seen through fog and steam, will assume a red tint, and when seen by itself, may not be of as decided a shade as is to be desired, but as in either case the light would be mistaken for colors that would mean stop, no dangerous condition would exist.

From the trainmen's standpoint the engineer can obey the indication of a signal, he must be able to see it, and if the speed of the train is to be high, the engineer must either get a view of the signal far enough away to enable him to properly control the train or else a distant signal must be provided which will be far enough away to enable him to bring the train under control in the space between the distant and the home signals. So long as the distant signal had to be mechanically connected and worked from a lever in a tower, it was not practicable to properly work the distant signal as far away as it should be put, but since power operated signals have been perfected they are used and put as far from the home signal as may be desired. Their cost is but little more than that of the mechanical signal, and besides being far enough away from the home signal they are much safer and more reliable in every way.



"ELECTRIC MOTOR AND MECHANISM OF UNION AUTOMATIC SEMAPHORE SIGNAL."

use of the continuous light spectacle is a great improvement over the 60 degree two-light casting or the single light casting with a shield, for in one case a light is shown to the engineer at all times, whereas with the use of a shield no light is shown when the signal is half way down and the lamp comes between openings in the two light spectacles.

Of late years signal engineers and superintendents have recognized the necessity of so locating a signal that it will be put in the best possible position to be seen by an approaching train and while a good view is not always to be had, the ground is usually very carefully gone over before a final location is made. The fact is recognized that before an

From the standpoint of the signal engineer, the science of signaling, or that part of it which has to do with development and construction, has been advanced very greatly in the last few years. New inventions and improvements have been made in all branches.

With the telegraphic block signal system the semaphore has, to a great extent, displaced the use of the revolving disk as a station signal, owing to the greater distance that the semaphore can be seen

and the particular advantage possessed by the latter in giving the indications by the position of the arm instead of by form and color.

The practice first adopted by the C., M. & St. P. Ry. of pointing the arms of all block signals in order to distinguish this signal from a switch or interlocking stop signal, has been followed by many roads and undoubtedly has much to commend it.

The three position signal or the giving of the stop indication by a horizontal position of the arm, the cautionary indication when the arm is at 45 degrees from the horizontal, and the clear indication when the arm is vertical, is used by but few roads, and does not seem to be gaining in favor. The Mozier three position signal, which allows the permissive indication to be given by inclining the arm upward, or above the horizontal position, has been adopted by several roads, the largest of which is the Santa Fe.

The controlled manual system has not come into very extended use and comparatively few installations have been made. Several different instruments have been perfected and work well, but the great cost of the system, together with the absolute character of the blocking necessary to insure safe working, are objectionable, and other systems have been installed in consequence. The necessity for a hand release in each office, to enable the signal to be worked in case of failures of the apparatus, is very objectionable, as by its use the signalman may make a mistake and admit a train under a clear signal when the block is occupied.

The automatic signal has been much improved and with the perfecting of the semaphore type of these signals, the disk signal, of which there are so many in use, is being superseded by the later signal. The disk signal is still preferred by a few, but the greater distinctness with which the semaphore can be seen and the positive manner of giving the indications are of such importance to trainmen that this type is regarded as a better signal and is being more generally used.

There are two prominent types of this signal now on the market. One is the motor driven, manufactured by the Union Switch & Signal Co., and the other is the electro-gas signal, made by the Hall Signal Co. The motor signal requires a battery of 16 cells to operate it and takes from 6 to 12 seconds to clear the signal according to the gearing used. The gas signal is worked by means of carbonic acid gas stored in liquid form in the usual iron "bottle" used by soda water manufacturers. One charge for the battery or a bottle of gas will operate the signal about 12,000 times, so that at 40 movements a day, recharging will have to be made only about once each year.

The differences of opinion in regard to the normal danger and the normal clear plan of arranging automatic signals still exist, and both are being used. A large road has equipped a division with the signals arranged on the normal danger plan, and an adjoining division with signals arranged to stand normally at clear. The normally clear arrangement is much easier of maintenance and inspection than where the signals stand normally at stop, and as there is but little difference in the cost of the battery required, the normally clear seems to be the more preferable arrangement of the two.

The Staff system for blocking trains is being introduced on many single track roads where there are difficult pieces of track to operate and where a collision

UNION SWITCH AND SIGNAL CO.'S MOTOR DRIVEN AUTOMATIC SIGNAL.

is apt to result in serious damage. The use of this system effects a great saving in the time required to move trains, as where it is used it is not necessary to give train orders and registers do not have to be checked. So much do the trainmen appreciate the saving in time effected over the train order method of dispatching trains, that where a staff machine was recently put out of service on account of the depot burning down the signal department was besieged with inquiries from the dispatcher, operator, conductor and enginemen to know when the new machine would be put up and ready for business.

Among the new systems of signals which are being tried, but which have not as yet come into extended use, the Rowell-Potter may be said to be the most promising and possessing the most merit. This system, although in use on elevated roads for a number of years, has been put in on the Chicago, Milwaukee & St. Paul Railway for trial and has been put to some severe tests. The principal part of the system is a safety stop or inclined bar which opens a valve on the engine and applies the air in case the signal should be run by, when in the stop position. An ingenious mechanism stores power in a set of springs by means of a track treadle worked by the deflection of the rail under the wheels of passing trains. The power so obtained is used to work a semiphore signal and the safety stop, and the cost of the battery employed to work the motor signal is saved. The system has not been in use long enough to demonstrate what it will do, but it has been inspected by many railroad officials, who were much interested in the trial now being made.

The Miller block signal, which is in use on the Chicago & Eastern Illinois and which is being tried in the Park avenue tunnel, New York City, gives the indications for clear and for stop by means of a red and a white light placed in the engine cab. For places like a tunnel, where it is almost impossible to see a signal situated on the side of the track, putting the lights in the cab may be a good thing, but as the apparatus will probably be smashed in case of accident, there would be no way of telling whether the apparatus had given a wrong indication or the engineer had failed to observe the stop indication. Engineers do not always observe the stop indications given by automatic signals, and would be much less likely to do so when there is no chance of their being detected in wrongdoing.

In the interlocking branch of signal work, improvements have kept up with that made in other lines, but they are not such as would be appreciated by those not interested in the maintenance or operation of such plants. The power operated mechanisms have been very fully developed, as evidenced by the electro-pneumatic, the pneumatic and the Taylor electric systems, which are being installed in many places.

With the mechanical plants, improvement has been made principally in the line of permanent construction, wood being done away with as much as possible and concrete and iron parts being used instead. The old practice of overloading levers is being generally abandoned, and a lever is now made to work only one signal or one derail. All switches and derails are bolt locked with the signal governing them, wherever practicable, in order to prevent the clearing of the signal in case the switch points are not properly closed.

The low-pressure pneumatic system and the Taylor electric system are the latest development in power operated interlocking plants. The low-pressure system is said to be economical in the use of air and free from the trouble occasioned by water collecting in the vent

holes and freezing up, preventing the movements from working. The movement of the switches and signals are controlled by valves, which are worked by air admitted to different sides of a diaphragm, to which the valves are connected. The Taylor electric system is a very ingenious one, and the details have been well worked out. Electric motors are used to work the switches and signals and the interlocked levers in a machine switch, the current in the wires running to each motor. By reversing the connections at the motor, by means of a pole changer, the motor at the end of the stroke is changed into a dynamo and made to generate sufficient current to release a lock on the lever in the machine and indicate that the movement of the switch has been completed. The electric current necessary for the operation of the Taylor machine can be taken from any electric supply station, but in places where current is not to be bought a gas engine and dynamo with necessary storage batteries have to be put in. The current required to work a switch is about 6 amperes at 110 volts and the time required about 1 second. A signal takes about the same time to clear and requires 3 amperes of current.

With most interlocking plants where the tracks are not too complicated to permit, it is now usual to put in electric locking of the levers so that a signalman cannot open a derail and ditch a train after the home signal has once been cleared for a train to proceed. This locking my be called a very necessary safety device, as some of the worst accidents occurring at interlocking plants have been caused by taking away the signals and opening derails when a train was so close to the derail that it was not able to stop before being ditched.

The Railway Porter's Mistake.

As the porter passed through the car she called him aside. There was a whisper and a gleam of silver.

"Now, remember, they are in the yellow satchel."

"Cyan't miss dem, ma'am."

"You won't let any one see you?'

"No, ma'am!"

"The Major is sitting in that car."

"He won't see me, ma'am."

"Well, here is the key."

The porter took the key and passed through to the next car.

"Guess dis am it," he said, slipping the thin key in the lock of a yellow satchel. He put his hand in the satchel and pulled out a bunch of hair. Then he relocked the satchel.

"Heah's yo' frizzos, ma'am!"

"Don't speak so loud."

"Anything else, ma'am?"

"That's all, I believe. I just have a minute to put these on before dinner."

The porter reached the platform in time to meet an irate tragedian.

"Not a step!" he thundered, in tones that almost lifted the porter's cap. "What have you done with my whiskers, boy?"

"Your whiskers, sah?"

"Yes, my false beard. The passengers say you opened my satchel with a skeleton key. Where are those whiskers?"

"Laws!" muttered the porter. "Ah went in the wrong satchel."

Just then a lady passed toward the dining car.

"Dah's yo' wiskers, sah!" grinned the porter, "On top ob dat lady's head."

—*Chicago Daily News*

The Pedrail, or Steam Horse.

It is well known that Nature's great pulling machine, the horse, possesses a hauling power altogether out of proportion to his weight. Mr. B. J. Diplock

ROWELL-POTTER AUTOMATIC BLOCK SIGNAL.
Photographed by W. H. Elliott.

has recently patented a traction engine that has something of the horse about it. This new species of steam "animal" is called the Pedrail. On the main axle is keyed a disk, and mounted on one side of this disk are 16 spokes capable of motion to and from the center. The spokes move round with the disc, but a spring attached to each keeps them normally drawn toward the center. On the end of each spoke is a foot, or, as it might be called, a circular hoof, pivoted by a ball and socket joint, so that it can turn through any reasonable angle. To this hoof is attached a roller, which comes up beside the disc on the other side from the spokes. The projecting spokes, each shod with a foot or hoof, if one may say so, causes the vehicle to advance when the disk is revolved, just as a wheel made with spokes and no rim would do.

In order to carry the weight of the machine, the axle box has attached to its underside a lever pivoted in the center, but capable of a certain amount of up-and-down movement in a slot. This lever has two springs at either end which grasp the ends of a similar lever which rests on top of the box and which is also pivoted about the center and this upper one is attached to the box by spring and carries the weight. The lower pivoted lever rests on top of two or three of the rollers, as they are successively passed under it. The pedrail, therefore, really carries a short rail under its axle box, and it permits the "feet" to firmly plant themselves on the ground and by means of rollers and "rail," moves forward. The system of levers, being pivoted and connected by springs, permits of inequalities on the road being passed over. Two guides at each end of the so-called "rail" keep the rollers from striking it on the end and always pass them underneath.

A steam horse, with feet behind pushing the wheeled vehicle along, was made in the early days of locomotive construction, but the boiler unfortunately burst with disastrous results, and the "steam horse" method of locomotion was abandoned.

Northern Pacific Tandems.

The confessions which we receive from trainmen on the Northern Pacific lead us to infer that the "battleships," as they call the tandem compounds, are far from being popular. The leading objection to the engines is that they devour too much coal. The remedy for this would be to equip the engines with automatic stokers. The engines appear to be highly efficient in hauling heavy trains, and their enormous capacity enables them to haul a ton at less cost than any other class of engines, and all that is necessary to make them popular is a mechanical stoker.

The great power of these engines was shown by a head-on collision some time ago. One of the giants ran into a train drawn by two smaller engines. The small locomotives were reduced to scrap, while the "battleship" escaped with a smashed pilot. For the convenience of the train crews, the load to be hauled by these engines has been fixed at 900 tons for the maximum.

The passenger department of the Rock Island has received four new café-observation cars for use on the El Paso line. The cars have six tables, seating 18 people, and an observation end that is commodious and comfortable. One advantage of this class of cars is that passengers can secure meals at all hours.

Of Personal Interest.

Mr. Arthur Hale has been appointed general superintendent of transportation on the Baltimore & Ohio, vice Mr. J. C. Stuart, resigned.

Mr. P. J. Raidy has been appointed chief train dispatcher of the New Castle division of the B. & O., to succeed J. R. Lusk, promoted.

Mr. J. A. Chisholm has been appointed chief engineer of the Mexican Great Eastern Railway, with headquarters in the City of Mexico.

Mr. E. H. Doherty has been appointed traveling engineer on the P. & I. and M. C. division of the Lake Erie and Western Railroad.

Mr. Bruce W. Duer has been appointed superintendent of the Pittsburg division of the Baltimore & Ohio, vice Mr. S. P. Hutchinson resigned.

Mr. B. F. Flory has been appointed to the position of mechanical engineer of the Lehigh Valley Railroad, vice Mr. F. F. Gaines, promoted.

Mr. John Haines, engineer on the Ohio Central, has been appointed assistant road foreman of engines on the same line under Mr. Engler.

Mr. W. C. Loree has been appointed superintendent of the Chicago division of the Baltimore & Ohio Railroad, vice Mr. D. D. Carothers, promoted.

Mr. Charles E. Dafoe has been appointed superintendent of Northwest Division of the Chicago Great Western Railway, vice Mr. J. A. Kelly, resigned.

Mr. C. E. Brittingham has been appointed traveling engineer and trainmaster on the St. Louis, Kansas City & Colorado, with headquarters at Union, Mo.

Mr. George Reed has been appointed chief train dispatcher of the Toledo and Lima Division of the Cincinnati, Hamilton & Dayton, vice Mr. J. H. Louy, resigned.

Mr. Charles S. Weston has been appointed superintendent of Wisconsin, Minnesota & Pacific division of the Chicago Great Western, vice Mr. C. E. Dafoe, transferred.

Mr. K. P. Alexander has been appointed master mechanic of the Fort Smith & Western Railroad, in charge of all equipment, with headquarters at Fort Smith, Ark.

Mr. G. W. Creighton, general superintendent of the Buffalo and Allegheny Division of the Pennsylvania, has been appointed general superintendent of the Altoona Division.

Mr. J. B. Dickson, assistant engineer maintenance of way on the Baltimore & Ohio Railroad, has been appointed engineer maintenance of way, vice Mr. M. L. Byers, promoted.

Mr. C. P. Chamberlain, assistant engineer on the Chicago Great Western, has been appointed division engineer at Des Moines, Ia., vice Mr. E. P. Mobley, assigned to other duties.

Mr. C. E. Brown, heretofore foreman at O'Keene, O. T., on the St. Louis & San Francisco Railroad, has been transferred to Neodesha, Kan., vice Mr. W. E. McEldowney, resigned.

Mr. H. J. Underhill, formerly road foreman of engines of the P. & E. Division of the Big Four, has been appointed train master of the same division, vice Mr. M. J. Wilson, resigned.

Mr. W. W. Williams, formerly a locomotive engineer on the Chicago & Northwestern, has been appointed trainmaster of the M. & D. division, with headquarters at Huron, S. D.

Mr. R. H. Briggs, formerly master mechanic on the Southern Railway, has been appointed division foreman on the St. Louis & San Francisco Railroad, with headquarters at St. Louis.

Mr. J. W. Brown, heretofore gang foreman at the San Bernardino shops of the Santa Fe, has been promoted to the position of general foreman of the company's shops at Needles, Cal.

Mr. S. C. Long, of the River and Low Grade Divisions of the Pennsylvania, has been appointed superintendent of the Allegheny Valley Division, vice Mr. R. L. O'Donnel, transferred.

Mr. G. W. Crownover has been promoted to the position of master mechanic on the Illinois Central at Freeport, Ill. He was formerly general foreman on the same road at Waterloo, Ia.

Mr. L. G. Haas, formerly general superintendent of the Pittsburg system of the Baltimore & Ohio, has been appointed assistant general manager of the B. & O., with headquarters at Baltimore, Md.

Mr. Thomas Anderson, general car foreman of the Wheeling & Lake Erie shops at Canton, Ohio, has resigned his position to undertake the management of the Youngstown Manufacturing Company.

Mr. R. L. O'Donnel, superintendent of the Allegheny Valley Division, was appointed general superintendent of the Buffalo and Allegheny Division of the Pennsylvania, vice Mr. G. W. Creighton, transferred.

Mr. I. G. Rawn has been appointed general superintendent at Pittsburg, on the Baltimore & Ohio, with jurisdiction over the Connellsville, Pittsburg, New Castle, Cleveland and Newark divisions, vice Mr. L. G. Haas, promoted.

Mr. J. H. Goggin, formerly yard master of the Chicago Yards and Terminal at Chicago, Ill., becomes assistant to Yardmaster Barry, of the New Castle division of the B. & O., with headquarters at New Castle Junction, Pa.

Mr. E. T. Canfield, formerly master car builder on the Delaware, Lackawanna & Western, has accepted service with the American Car & Foundry Company. His resignation was accepted with much regret by the Lackawanna.

Mr. Charles Gabriel, who for the past eight years has been road foreman of engines on the Hocking Valley, has accepted the position of superintendent of machinery with the Tombstone Consolidated Mining Company of Arizona.

Mr. J. R. Lusk, formerly assistant superintendent of the P. & W., and later chief train dispatcher of the New Castle division of the B. & O., has been appointed assistant train master, with headquarters at New Castle Junction, Pa.

Mr. J. H. Burns has succeeded Mr. T. H. Yorke as division master mechanic on the Chicago Great Western at Dubuque, Ia., and Mr. T. H. Yorke has been made division master mechanic at Fort Dodge, vice Mr. Geo. Gregory, resigned.

Mr. L. T. Ford, at present assistant engineer of the Philadelphia Division of the Pennsylvania Railroad, has been appointed superintendent of the Chautauqua Division of the Allegheny Valley Railroad, vice Mr. C. B. Dabney, transferred.

Mr. Miles Gibson has been appointed road foreman of engines on the Big Four to succeed Mr. H. J. Underhill, promoted. Mr. Gibson has been fifteen years on the road and has the reputation of being one of the best enginemen in the service.

Mr. C. B. Dabney, superintendent of the Chautauqua Division of the Allegheny Valley Railroad, has been appointed superintendent of what is known as the River and Low Grade Division of the Pennsylvania, vice Mr. S. C. Long, transferred.

Mr. Lewis Ohlinger, superintendent of the Richmond Division of the Pennsylvania, will succeed Mr. W. C. Loree as superintendent of the Indianapolis Division. Mr. Otto Schroll, superintendent of terminals at Wheeling, will succeed Mr. Ohlinger at Richmond. Mr. A. L.

Morgan, engineer of maintenance of way on the Pittsburg Division, has been appointed superintendent of the Wheeling terminals.

Mr. M. L. Byers, engineer maintenance of Way on the Baltimore & Ohio, has been appointed assistant to the general manager. He will assist his chief in matters pertaining to the analysis of operations and the analysis and control of expenses in all the departments.

Mr. J. A. Middleton, second vice-president of the Erie, has been appointed assistant to Mr. E. B. Thomas, the new president of the Lehigh Valley Railroad Company. Mr. Middleton will have general direction of both the Lehigh Valley Railroad and the Lehigh Valley coal companies.

Mr. E. T. Horn, late of the Canada Midland, was appointed assistant to the general superintendent, with headquarters at Pittsburg, Pa. Part of Mr. Horn's work will be the planning and straightening out of new and old yards, and classifying freight, with a view to reducing delays in yards.

Mr. C. F. McDermott, who has been in the service of the B. & O. for about 30 years, and who was division master mechanic of the Chicago division of that road, with headquarters at Garrett, Indiana, has resigned, and his place is now filled by Mr. J. H. Tinker, master mechanic of the Pennsylvania lines at South Amboy, N. J.

Employees of the Pennsylvania Railroad about Pittsburg gave a very handsome Christmas gift to Mr. R. P. Pitcairn, assistant to the President. It was a grandfather's clock which cost $2,000. About 1,000 persons witnessed the presentation, many of them having worked under Mr. Pitcairn, who was a remarkably popular superintendent.

Mr. A. E. Long has been appointed acting superintendent on the Great Northern Railway, in place of Mr. B. F. Egan, whose fate has been uncertain. Mr. Egan went on a hunting expedition in the mountains several weeks ago, and though search has since been carried on steadily by over 200 men, no trace has yet been found of the missing man.

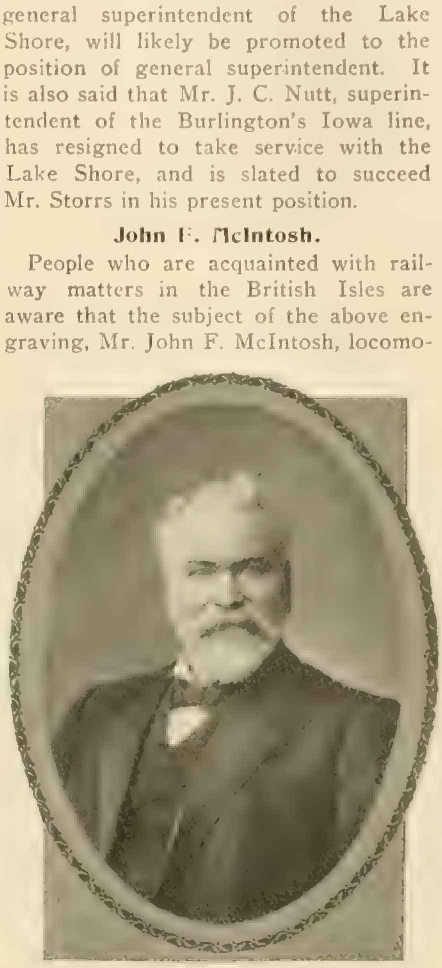
Mr. C. A. Moore, of Manning, Maxwell & Moore, is indulging himself in a well earned holiday, which will last about six months. He has taken his family abroad, and will visit many strange places before he returns. The party are spending part of the winter in Egypt, from whence they will go to India, and perhaps China and Japan.

Mr. J. H. O'Neill, formerly train master of the Great Northern at Great Falls, has been appointed superintendent of the Montana division of the road with headquarters at Havre. He succeeds Mr. A. E. Long, recently appointed superintendent of the Kalispell division. Mr. O'Neill has been in the employ of the company for many years, having commenced as brakeman, serving as through train service brakeman and conductor.

Mr. W. H. Marshall, general superintendent of the Lake Shore, will probably be appointed general manager of that property, and Mr. H. S. Storrs, assistant general superintendent of the Lake Shore, will likely be promoted to the position of general superintendent. It is also said that Mr. J. C. Nutt, superintendent of the Burlington's Iowa line, has resigned to take service with the Lake Shore, and is slated to succeed Mr. Storrs in his present position.

John F. McIntosh.

People who are acquainted with railway matters in the British Isles are aware that the subject of the above engraving, Mr. John F. McIntosh, locomo-



JOHN F. McINTOSH.

tive superintendent of the Caledonian Railway, took the lead in introducing heavy locomotives and heavy freight cars into Scotland. His lead in this work is now receiving much following by other railway companies, but Mr. McIntosh deserves the credit of taking the initiative in this great reform.

Mr. McIntosh rose to his present position of locomotive superintendent of the Caledonian Railway through the shop and the footboard. His experience was much the same as many of our officials have gone through, who passed through the grades of traveling engineer, general foreman, master mechanic, and assistant superintendent of motive power before reaching the top. The writer and Mr. McIntosh were associated together at one time on the same division, and we lodged in the same house. We were both ambitious to "get on," and no doubt reflected upon each other the powerful influence of mutual aspirations.

Mr. S. P. Hutchinson, formerly superintendent of the Pittsburg division of the Baltimore & Ohio at Pitsburg, Pa., has been appointed assistant to the general superintendent of the Michigan Central, with headquarters at Detroit, Mich. Mr. B. W. Duerr, recently appointed assistant to Mr. J. C. Stuart, general superintendent of transportation, will have his headquarters at Pittsburg, Pa. He succeeds Mr. Hutchinson as superintendent of the Pittsburg division.

We are pleased to notice that our friend, Mr. E. W. Pratt, who has been for some time master mechanic of the Chicago & Northwestern Railway, at Mason City, Iowa, has been appointed successor to Mr. S. A. Teal, for years head of the mechanical department of the Fremont, Elkhart and Missouri Valley Railway. Mr. Pratt has been one of the best friends of RAILWAY AND LOCOMOTIVE ENGINEERING, and was for years a very successful agent for the paper. The system he now has charge of comprises 1400 miles in Nebraska, Wyoming and South Dakota. We have no doubt that Mr. Pratt will achieve as much success in the wider field which he is called upon to manage as he met with as division master mechanic.

Among the changes recently effected in the official staff of the Pennsylvania Railroad, Mr. A. W. Gibbs has been advanced to be general superintendent of motor power, succeeding Mr. Atterbury, made general manager. We do not mean to disparage any of the men who have been passed over by the promotion of Mr. Gibbs, but we think the appointment a remarkably wise one. The conspicuous characteristic of Mr. Gibbs as a mechanical engineer is sound good sense, with a conservative tendency that will prevent the company from paying expensive tribute to false gods. It was only a short time ago that Mr. Gibbs was advanced from assistant mechanical engineer to be superintendent of motive power of the Philadelphia, Wilmington & Baltimore, a position he has been filling very successfully. Mr. Gibbs has enjoyed considerable experience outside of the Pennsylvania Railroad, which increases his resources as a designer and as an executive officer.

In February last, Mr. J. F. Deems left the position of superintendent of motive power of the Chicago, Burlington & Quincy, to become general manager of the Schenectady Locomotive Works. He achieved decided success in managing that great manufacturing establishment, but he is now leaving it to become general superintendent of all the Vanderbilt lines, a position similar to that held by Mr. T. N. Ely on the Pennsylvania system. Mr. Deems possesses in an eminent degree the qualities which push men upwards. The success he has attained has been laboriously worked for. He

worked his way through college by teaching school; then he entered the B. & O. shops as special machinist apprentice. From there he went to the C., B. & Q., and began work as a machinist; but very soon was advanced to gang boss. Steadily he went upwards, until he became superintendent of motive power. The first time the writer heard Mr. Deems speak, in the Master Mechanics' Convention in 1894, the reflection came—that man will be a leader some day. The prediction has come true.

W. C. Chapman.

Hosts of railroad men will recognize the portrait of Mr. W. C. Chapman, who was for years traveling engineer on the Fremont, Elkhorn & Missouri Valley Railroad. Mr. Chapman is wonderfully well informed on everything pertaining to railway rolling stock. He has been the agent for RAILWAY AND LOCOMOTIVE ENGINEERING for a a long time and made a great success of the business.

Mr. Chapman commenced work for the Chicago & Northwestern Ry. Company in October, 1863, working in Clinton shops, Iowa, and running a locomotive until 1865, when he was put in charge of shops at Woodbine, Iowa. He stayed at that point until August, 1866, when he was transferred to Dunlap, Iowa, in charge of the shops, until 1882; next, he was transferred to Eagle Grove, Iowa, in charge of the shops of the Northern Iowa Division of the C. & N. W. Ry. He remained on this division until February, 1888, when he was transferred to the Fremont, Elkhorn & Missouri Valley Ry., a system of the Chicago & Northwestern Ry. He was in charge of shops at Chadron and Fremont for three years, after which he was appointed traveling engineer for the whole system of the F., E. & M. V. Ry., 1,408 miles of railway. He held this with an assistant west of Long Pine, Neb., until April, 1902, when he was retired on a pension, being with that company for nearly 40 years. During the last ten years he had examined nearly 1,200 men on 1, 2 and 3-years Mechanical and Air Brakes. When he commenced on that road (C. & N. W.), the railway was running only to Marshalltown, Iowa, 150 miles west of the Mississippi river. Now it is double-track through to the Missouri river. The Union Pacific was not thought of at this time (1863). Engineers then ran from Clinton, Iowa, to Cedar Rapids, Iowa (82 miles), the first day; to Marshalltown, the next day, and the third day back to Clinton (150 miles). Now engineers run from Clinton to Boone (202 miles), and from Boone to Omaha (156 miles). Mr. Chapman has seen all this improvement in his service with the C. & N. W. Ry. Co. Before going to the North-Western, he was with the C., B. & Q. Ry. five years. So we can see he is an old settler.

To Vanquish the Hudson River.

The Hudson river has long stood like a wide chasm cutting off the island of Manhattan on which New York city is built from the New Jersey shore from where nearly all railroads running to the West and South have their termini. A few months ago the Pennsylvania Railroad Company astonished New Yorkers by the announcement that they intended to tunnel under the Hudson and carry their tracks underground to a great station to be built nearly as far north as the Grand Central Station of the New York Central.

W. C. CHAPMAN.

Various schemes had been proposed for bridging the Hudson, but they all came to nothing.

Now that an earnest endeavor is on, to take trains into New York, other railroad companies are following the lead of the Pennsylvania, among them the Erie. Rumor says others are moving in the same direction.

Be diligent, work for a steady independence and be happy.—*Dombey and Son.*

Peat-Fuel Briquettes Successful in Canada.

In view of the grave anxieties which the fuel problem has recently excited, it is of more than passing interest to learn from the U. S. Consul at Toronto that peat briquettes may be produced in Canada ready for shipment at a maximum manufacturing cost of $1.50 per ton. He says: "There is, however, some difference of opinion as to the length of time a given weight of peat briquettes will burn, as compared with the same weight of anthracite; theoretically, the heat units in peat being fewer, it may be argued, it must burn out faster; but with effective control of drafts, it is surprising how nearly its lasting quality approaches that of hard coal, due doubtless to the fact that more perfect combustion is usually had in the burning of peat under ordinary conditions, the waste in burning coal certainly being greater than in peat briquettes, both fuels being fired by methods in common use."

This peat fuel has been made at the property of the Peat Industries, Limited, near Welland, Ont., and at the Berner bog by the Stratford Peat Company. It is expected that next spring will see considerable activity in peat-fuel manufacturing in Canada. If, as Mr. Gunsaulus tells us, it nearly approaches hard coal in lasting qualities, there may be a future for it as locomotive fuel, while its price would commend it everywhere.

Round the World Telegraph.

Sir Sandford Flemming, living at Ottawa, Canada, recently sent a message by the new "All Red" cable to the Mayor of Ottawa, who lives a few streets away, with the request that the operators along the line insert the local time of receiving the cable. The message belted the world, passing over land entirely of British territory, in six hours and three minutes, thus beating former records by four hours. Supposing the telegram had been a material object and had traveled round the equator, a distance of 25,000 miles, it would have gone forward at an average rate of 68.87 miles per minute, or 4,132.2 miles an hour.

We understand that Mr. W. P. Appleyard, M. C. B. of the N. Y., N. H. & H. Railroad, is putting his patented copper covering on 150 passenger cars. The Underground Railroad Company of New York have arranged to cover 500 of their cars with copper as a means of making them fireproof.

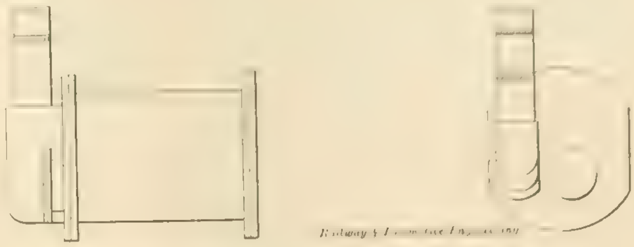
Evolution of the Locomotive Boiler.

BY O. H. REYNOLDS.

It may seem like a wide stretch of fertile imaginative powers to even try to establish a connection between the crude devices for generating steam of the time of Hero, the Alexandrian philosopher, and earlier periods (for the force of steam was known to remote antiquity) and the locomotive boiler of the present day, but it will not be denied that the simple vessels of the ancients were the germs from which has grown the steam generators of the world's industries. The present state of the art has, however, been attained by the crystallization of the best thought of only 100 years, for it was in 1802 that Richard Trevithick patented the principle of the non-condensing high-pressure engine, the purpose of which was to haul vehicles on rail-

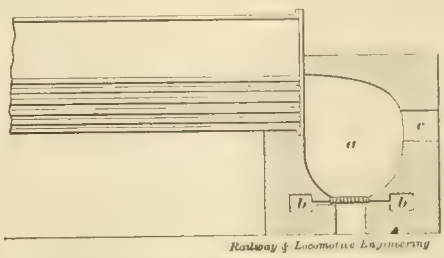
MR. O. H. REYNOLDS, ENGINEER.

ways by the expansive force of steam; and while there was little resemblance between the first boiler built under that patent to those following—it being of such insignificant proportions as to be carried low down and at the back of the rear axle—yet from this bellows drafted boiler sprang the monster locomotive boiler of 1903. In 1803, Trevithick built an engine for the Merthyr-Tydvil Railway, in Wales, having a cylindrical boiler with a return flue and furnace inside. In this boiler was probably made the first attempt to utilize the exhaust steam to induce draft, by diverting it into the stack. There appears to have been little progress made in boiler design from 1803 to 1814, attention seemingly having been centered on various methods of propulsion, but in the latter year George Stephenson built an engine at the Killingworth Colliery having a cylindrical boiler 34 inches in diameter and 96 inches in length. This boiler had one internal flue 20 inches in diameter, passing from end to end. In the previous year William Hedley, chief engineer of Wylam colliery, near Newcastle, had built a locomotive with a return flue boiler, an improvement on that used by Trevithick. That boiler was entirely satisfactory as a steam generator for the slow speed of coal trains. That Trevithick's boiler had little influence on pioneer locomotives was due to the fact that its designer did not follow up the work of locomotive building.

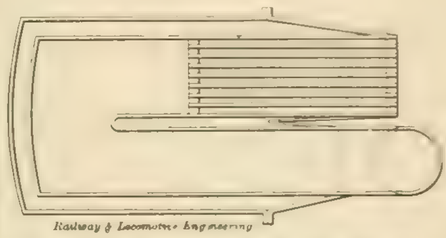


TREVITHICK'S RETURN FLUE BOILER.

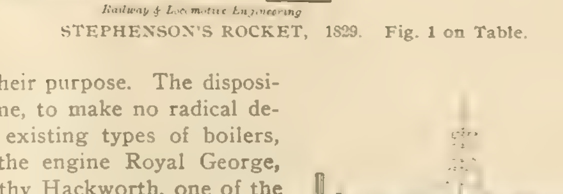
The progress made in boiler improvements was necessarily slow from 1814 to 1827, as the locomotive had simply to keep pace with the demands of the time for motive power, and as these demands contemplated nothing but freight movement, and that at not more than 3 to 8 miles an hour, the boilers then in use fairly served their purpose. The disposition of the time, to make no radical departure from existing types of boilers, is shown in the engine Royal George, built by Timothy Hackworth, one of the ablest of the pioneer locomotive designers. This boiler was also cylindrical, 52 ins. in diameter, by 13 ft. in length, with an internal tube, in which the fire grate was carried. It was on this engine that the exhaust pipe was first made to produce satisfactory results in stimulating combustion by passing the exhaust through the stack, notwithstanding the idea was tried 23 years before, and had been used with varying degrees of success, even having been abandoned previous to 1825, as detrimental to fuel economy, although it was conceded to be a great aid to combustion. This event marked the most important step in boiler construction, being the first real improvement affecting the steaming capacity of the locomotive boiler. Much thought had been given to the subject of draft, but most of the experiments seemed to have been devoted to fans to gain the object sought. The passing of the exhaust steam into the stack for the purpose of inducing draft on the fire, as then applied, has not been improved on, except in minor details, the principle re-



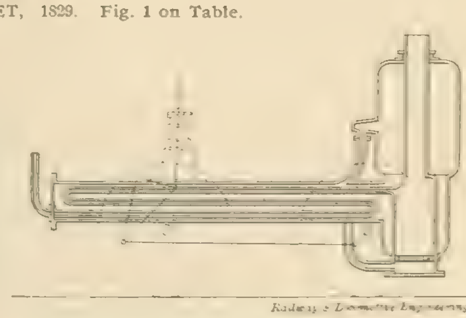
SEGUIN'S MULTITUBULAR BOILER, 1827.



HACKWORTH'S RETURN FLUE BOILER. Used in "Nonpareil" Engine, that was in competition with Rocket, 1829. Fig. 2 on Table.

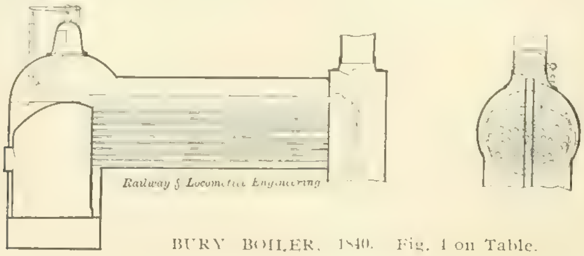


STEPHENSON'S ROCKET, 1829. Fig. 1 on Table.



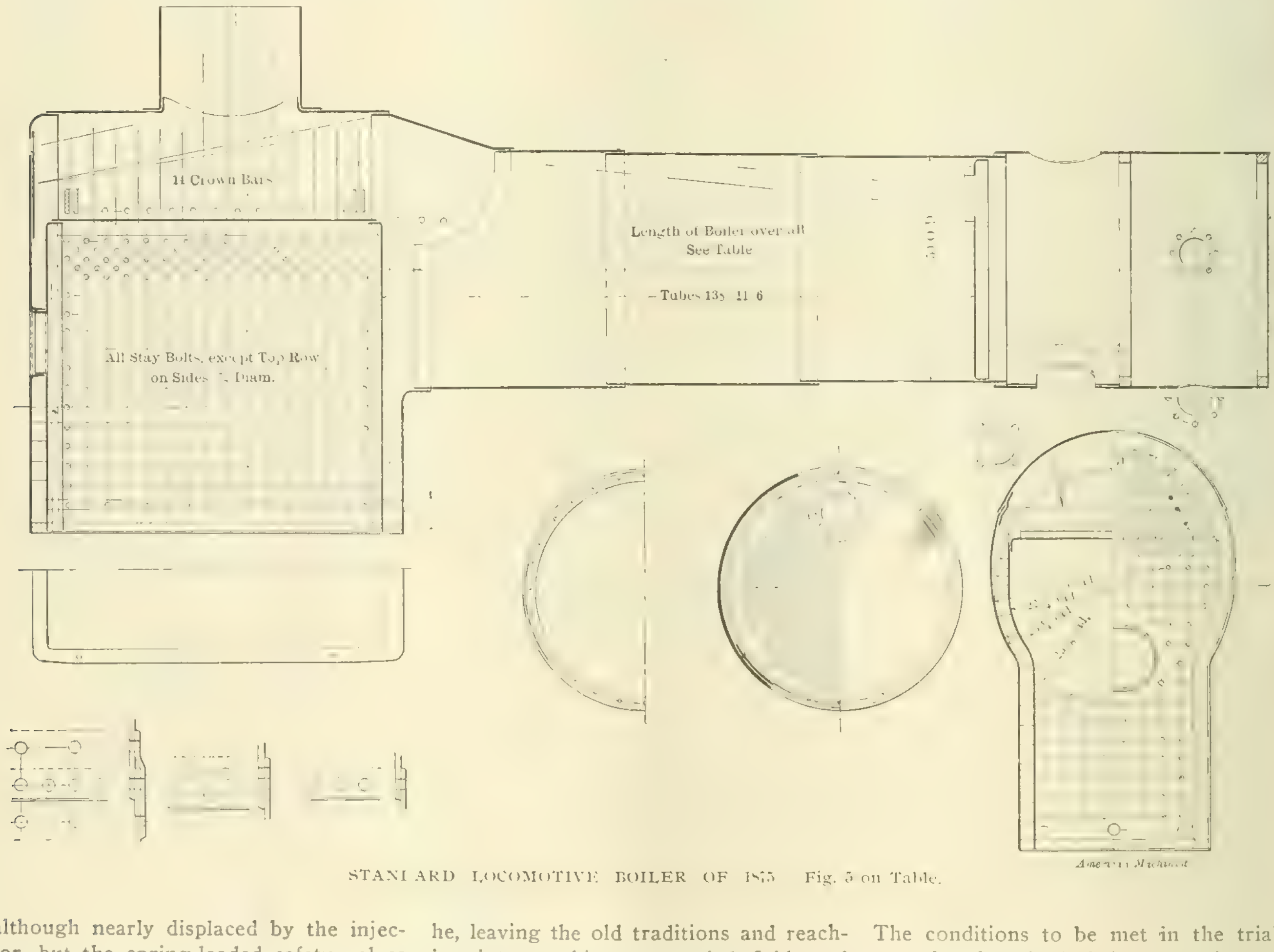
BOILER OF ERICSSON'S NOVELTY. Fig. 3 on Table.

maining to-day practically the same as perfected by Timothy Hackworth in 1827, who, at this time, also made some experiments in feed-water heating, by turning the exhaust at will from the stack



BURY BOILER, 1840. Fig. 1 on Table.

into a reservoir carried at the front of the boiler. The builders demonstrated their original ideas in numerous other directions at this period, among them being the application of the feed pump, and spring loaded safety valves to this boiler. The pump is still in use as a boiler feeder,



STANDARD LOCOMOTIVE BOILER OF 1875. Fig. 5 on Table.

although nearly displaced by the injector, but the spring-loaded safety valves remain in a modified form to remind us that Hackworth was building wiser than he knew when perfecting his machine.

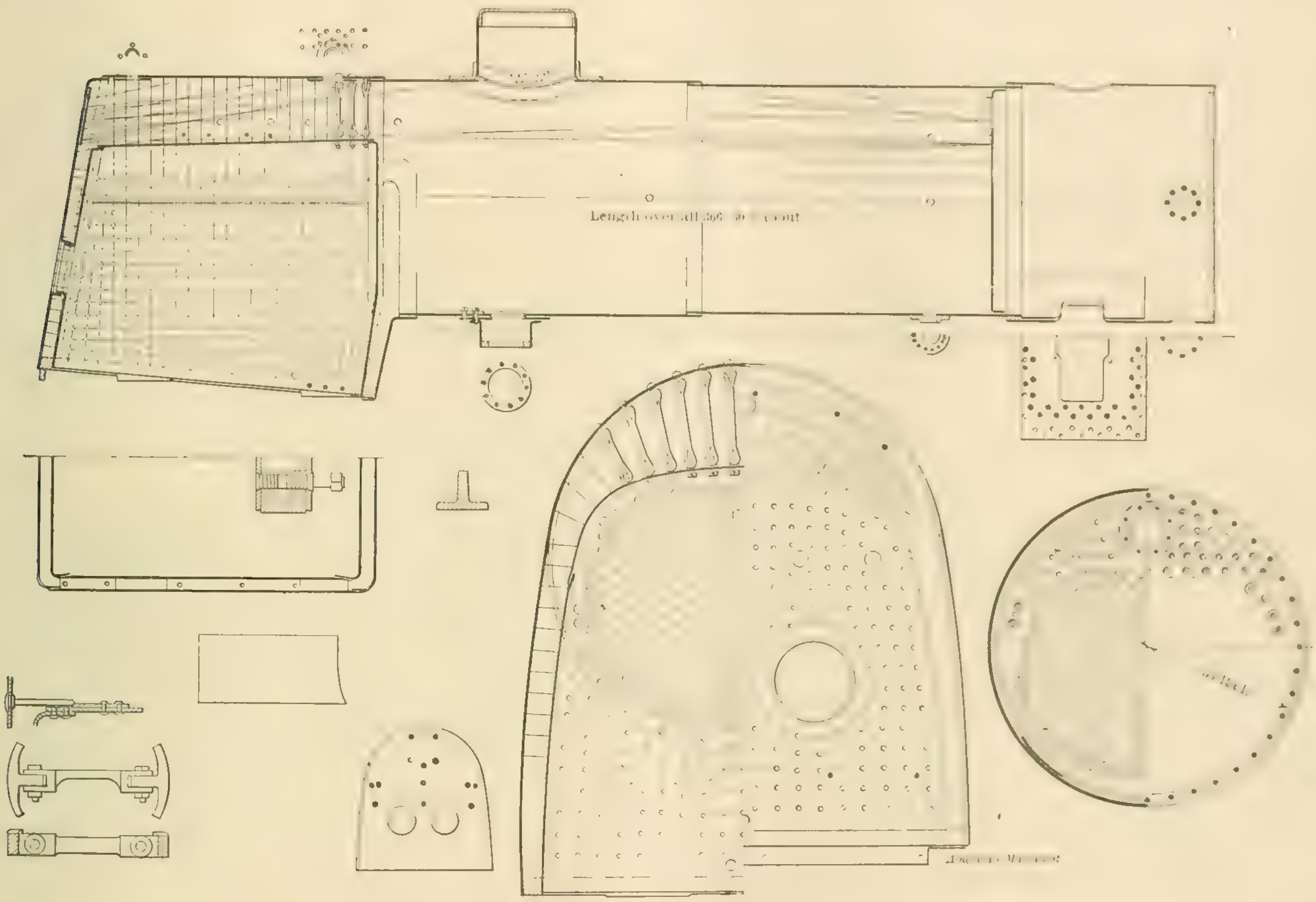
Boiler development up to 1827 contemplated the cylindrical form with a combustion tube, as touching the limit of possibilities. This tube, extending from the grate and being continuous, was elevated at front so to form a high stack, receiving the flame and gases which were supposed to impart their heat to the water surrounding it. Crude as this may appear, such a boiler made steam rapidly enough for slow work of the time, but could hardly be termed an economical device, and the investigators set about producing a boiler with more heating surface, and therefore a higher evaporation, which from their reasoning could best be furnished by an increased tube surface. To M. Seguin, an eminent French engineer, is due the honor of applying this system to locomotive boilers, he, leaving the old traditions and reaching into, to him, an untried field, and revolutionizing boiler design. This he did on an engine furnished from England by Stephenson, which was of the single flue type. A practical trial of the idea showed the accuracy of Seguin's reasoning, when he gave to us the multi-tubular arrangement, the principle of which is used to-day on every locomotive. In this connection, it should be said that Seguin used the fan to urge the fire. Credit of first applying, in 1827, the multi-tubular idea should, however, be given to Stevens, of Hoboken, N. J., for original thought in this direction, for in 1825 he had built a small railway, on which to experiment with his conception of a locomotive. The boiler brought out was of the vertical type, having tubes 1 1-4 inches in diameter, being no doubt the genesis of our small stationary boilers, to which it was quite similar. The problem of rapid transmission of heat, on which the evaporative efficiency of the locomotive boiler depended, was found in the multitubular principle, which has been the standard form on succeeding boilers.

Boiler history was rapidly made from this time on. the greatest incentive to which. perhaps, was the premium offered by the Liverpool & Manchester Railway in 1829, for the best locomotive engine. The conditions to be met in the trials were for that time of the most rigorous character, among which was one that the boilers should consume their own smoke. What food for reflection for the cloud-producers of the twentieth century to read these lines, and be reminded that these pioneers were expected to give results that require expert treatment to produce to-day. There were three engines entered for this contest, namely, the Rocket, built by Robert Stephenson, the boiler of this engine being 40 inches

in diameter and 72 inches long, with 25 tubes 3 inches in diameter. The firebox was 24 inches long by 36 inches wide and 43 inches deep inside. The grate surface was 6 sq. ft., the firebox heating surface was 20 sq. ft. and that of the tubes 117.75 sq. ft. This was the first multi-tubular boiler built in England. These proportions, it may be well to say here, were remarkably near to correct modern design for the cylinders of this engine, a result which was, of course, purely accidental, as nothing was known at that time about heating surface requirements, except in the most vague way.

36 ft. long. The heating surface of this firebox was 9.5 sq. ft., that of tube was 33 sq. ft., while the grate area was 1.8 sq. ft. Here was as widely a differing lot of types as could well be imagined, entered for a trial that was to determine, not only superiority for that occasion, but was to settle for the future the general design of the locomotive boiler. The results of the trials show the Rocket to be the only engine to make the 70 miles constituting the runs. The Rocket's average evaporation was 5.34 pounds of water per pound of coke, against an average evaporation of 2.2 lbs. of water

pursuing an *ignis fatuus*, as will be shown by the evaporation data for these engines, which had 306 and 283.8 square feet of flue heating surface, respectively, as against the 117.8 square feet of the Rocket, and an evaporation of 6.64 lbs. per pound of coke for the Phoenix, with 9.61 lbs. for the Arrow. In the competitive trials, while the evaporation of the Rocket was far above the other boilers, the results as then obtained were improved upon afterward by decreasing the diameter of exhaust tip for the purpose of stimulating the draft. The light thus gained on drafting was no doubt made



NEW YORK CENTRAL BOILER. 1 01 Fig. 6 on Table.

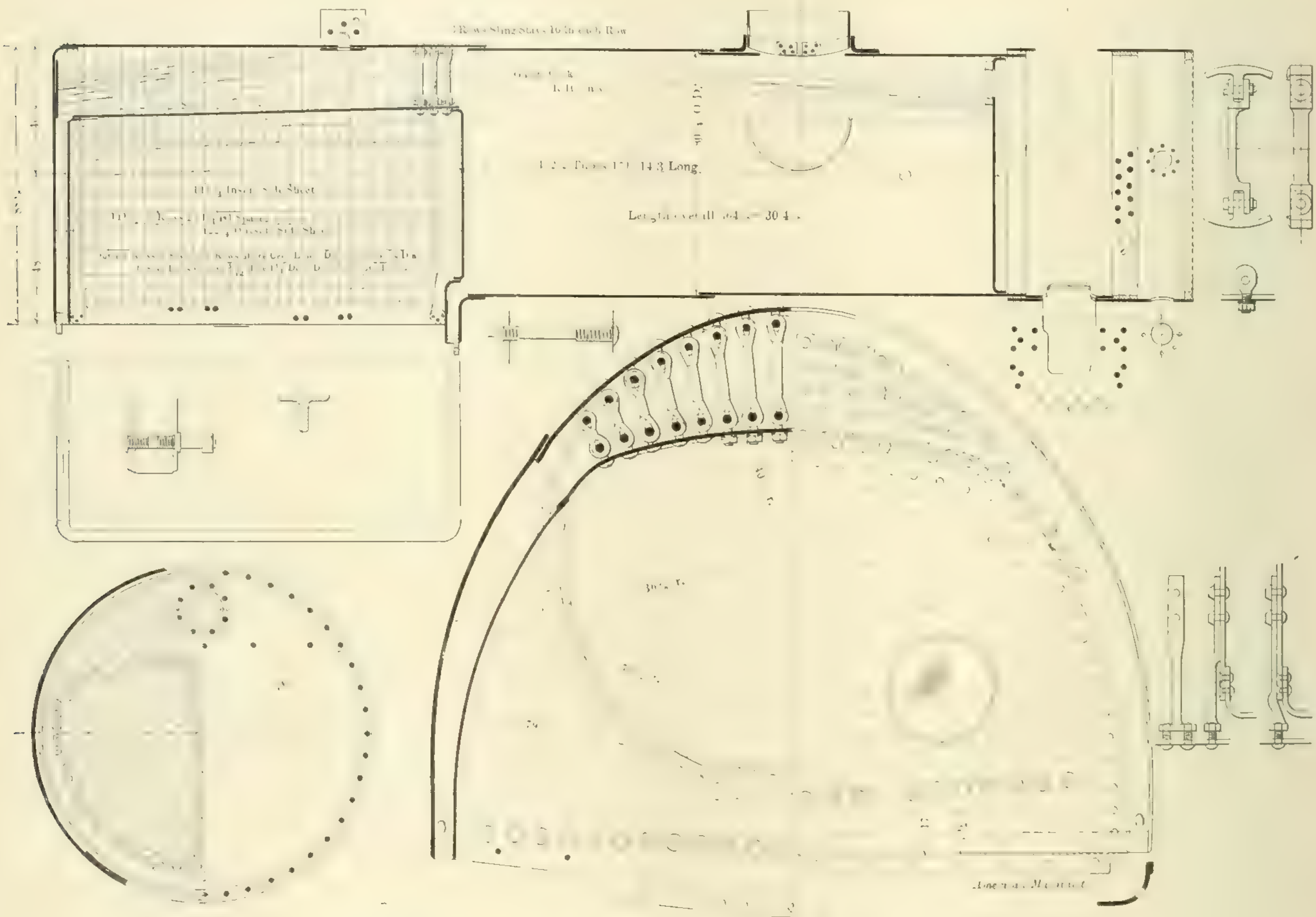
The second engine, the Sanspareil, built by Timothy Hackworth, had a cylindrical boiler 6 feet long and 50 inches in diameter, with a single tube 24 inches in diameter at the grate and 15 inches at stack, having a return bend. The firebox heating surface was 15.7 sq. ft., and grate area was 10 sq. ft., while the tube heating surface was 74.6 sq. ft. The third engine in the contest was the Novelty, built by Braithwaite and Ericsson. The boiler of this engine was a wonderfully complex affair, having a vertical firebox surrounded by water, and one tube 4 inches in diameter, immersed in a horizontal section of the boiler, through which it passed three times by return bends before entering the stack, the flue being made by the Sanspareil. There is no record of the boiler performance of the Novelty, that engine having suffered from a number of break-downs. Enough data was, however, deduced to firmly entrench the multi-tubular type of boiler in its place as the correct thing for use with the locomotive. This belief was confirmed at once by the Stephensons on two later engines (1829-30), the Phoenix and Arrow, each of which had a greater tube heating surface than their predecessor, the Rocket, the grate areas and firebox heating surfaces remaining the same. The beneficial results from the increased heating surface were at once apparent, giving all the evidence needed to convince the experimenter that he was not use of on the Phoenix and Arrow and other of Stephenson's engines of 1829-30. The success of Robert Stephenson in these trials indicates fully the depth of resource of the man—his ability to take advantage of means to ends, as was evidenced by his adoption of Trevithick's and Hackworth's scheme of induced blast from the exhaust, the one essential necessary to the success of his multitubular boiler.

Hackworth, still loyal to his single flue idea for a boiler, had his engine Globe built at Stephenson's in 1829-30. This boiler was fitted with a series of small circulating tubes placed in the single flue, a design which was found to make an excellent lodging place for sedi-

ment, but the boiler deserves mention only from the fact that it had a copper dome on the top, the first locomotive boiler to be fitted with a steam dome, with the view to a drier steam supply. The same brain worked out some new boilers in 1830, which contemplate a single flue opening into a combustion chamber, from which the gases of combustion were conveyed to the smoke box by a series of small tubes. This boiler was said to be remarkably long-lived and a free steamer. Hackworth has left the impress of his genius on many locomotive details, but those applying to the boiler, as enumerated in the foregoing, have won a place at the top of the honor scroll for his name.

Another aspirant for fame in locomotion design appeared in 1830 in the person of Mr. Edward Bury, who proceeded to embody some original thoughts of his own, and also of his contemporaries, in an engine built for the Liverpool & Manchester Railway. Bury was not slow to adopt and use the steam dome on this and his subsequent engines. The design and proportions of this dome were such as mark the inventor's personality, he having been the first to give any semblance of liberality to this important detail of the boiler. There is not any doubt about the purpose of these large Bury domes—they were designed for a steam reservoir, and filled that function most admirably. This type of boiler had an extensive following for several years, it having been copied in England in 1838, and in America by the Norris's in 1840, and also by Stephenson in 1846. It was again given a vogue by American builders about 1850, after which the rectangular firebox and separate domes became recognized as the standard form of construction.

Among the improvements in boiler design may be cited the abandonment of the crown bar for radial staying, and the close attention given the strength of riveted joints, which are invariably of the butt joint type with welt strips for the longitudinal seams, giving an efficiency of nearly or quite 90 per cent. of the solid plate; this care in construction being, of course, due to the high pressures now necessary. The boilers herewith illustrated tell their mute tale of progress from the days of 50 pounds pressure of the early ones, to the 225 pounds of the latest product of the American Locomotive Company, the latter being selected to show average modern practice in locomotive boiler construction.



A MODERN LOCOMOTIVE BOILER WITH WIDE FIRE-BOX. Fig 9 on Table

LOCOMOTIVE BOILERS, FIRST AND LAST.

Fig.	Build.	Cyl.	Pressure	No. of Tubes	Dia. Tubes in.	Length Tubes, ft.	H. S. Tubes sq. ft.	H. S. Fire box sq. ft.	H. S. Total sq. ft.	Grate area, sq. ft.
1	Stephenson 1829	8x16½	50	25	3	6	117.75	20	137.75	6
2	Hackworth 1829	7x18	50	1	24	4 ft. 2 in.	74.6	15.7	90.3	10
3	Ericsson 1829	one cyl. 6x12	50	35	1	35	33	9.5	42.5	1.8
4	Bury 1840	....	90	96	2	9	452	52	504	10
5	Standard 1875	17x24	140	168	2	11 ft. 6 in.	1123	119	1242	17
6	Am. Loco. Co. 1901	21x26	200	306	2	16	3325	180	3505	50.3
7	Am. Loco. Co. 1902	22x26	200	309	2	14	2272	193	2466	34.5
8	Am. Loco. Co. 1902	21x32	210	396	2	15 ft. [illegible] in.	3159	188	3347	62.18
9	Am. Loco. Co. 1901	22x30	190	462	2	14 ft. 3 in.	3423	238	3661	90

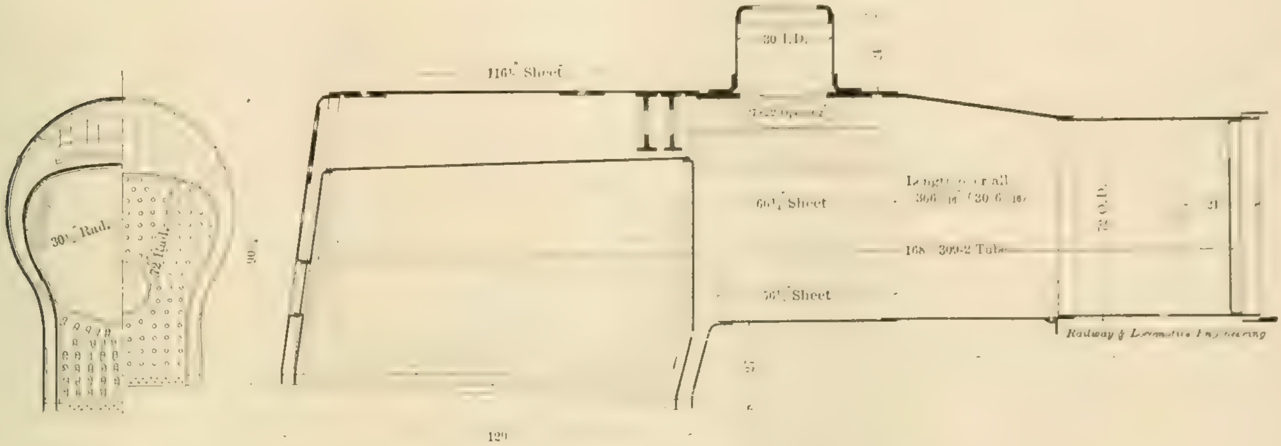
A Chance for Inventors and the Ablest Chemist.

The following paragraph is from the editorial page of one of the largest and most influential of our metropolitan dailies. It says: "Suicides and accidental deaths from inhaling gas are now so frequent that it may not be fantastic to suggest to the ablest chemists that they may perhaps benefit the race by looking into the question whether or not it is possible to supply gas for lighting and heating and cooking not so heavily charged with deadly poison to human lungs."

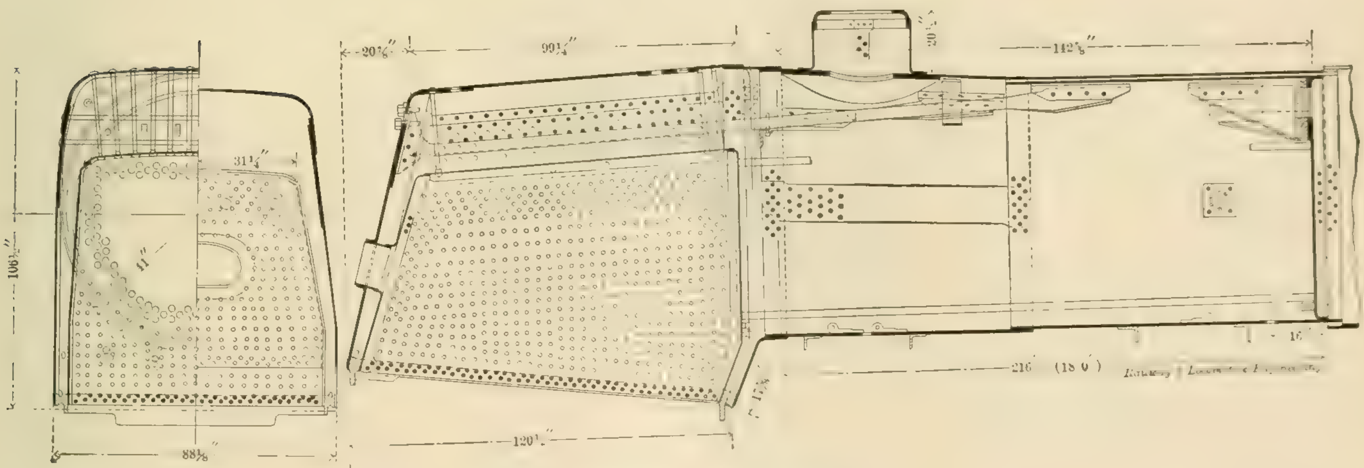
Taken as an example of "Newspaper Science," this is good. As a matter of fact, the gas referred to is not poisonous, it simply does not contain oxygen, and free oxygen is necessary to life. A much wider field would be opened up for the inventor and for the ablest chemist, if they would separately or in conjunction invent and supply us with "non-drowning" water. This harmless beverage is not poisonous; it contains oxygen, and yet people who have their lungs completely filled with it, invariably succumb. Arise, ablest chemist, and do something!

The Safety Car Heating and Lighting Company of 160 Broadway, New York, have issued a neatly printed little brochure on the Pintsch system of Car and Buoy lighting. The system is of German origin, having been promoted and developed in order to provide a safe substitute for oil for the illumination of railway cars. It is used not only in Europe, but in India, Africa, South America, and, in fact, in almost every civilized country in the world. In the United States there are no less than 63 Pintsch gas plants in operation. These stations have apparatus for the safe storage of oil, the convertion of the oil by fractional distillation into a fixed gas, and appliances for compressing the gas. The richness of the gas is such that from 10 to 12 candle-power per cubic foot can be obtained from it, while ordinary city gas, which has not been subjected to compression, does not give more than 2 candles per cubic foot. This booklet, abounding in interesting facts and figures, will be given away free by the company upon application.

The American Brake Shoe and Foundry Company, of 170 Broadway, New York, have issued an illustrated pamphlet on steel castings made by the "Tropenas" process. This process is one of the many methods of converting pig iron into refined steel, of which the Bessemer process was the original. The booklet gives information concerning Tropenas steel, what it is, and what can be done with it, and details the almost innumerable variety of small intricate castings which can be well made of by the process. The company will cheerfully forward the pamphlet to those who are anxious for information of this kind, on application.



ABOVE FRAMES, IOWA CENTRAL, 1902. Fig. 7 on Table



BROOKS BELPAIRE. Fig. 8 on Table

Messrs. Dodge & Day, modernizing engineers, have been commissioned by their clients, the Heating, Ventilating and Foundry Co., of Pittsburg, to fully equip the new plant which is being erected for that company at Wheeling.

Packing.

The word "packing" for the rings of pistons originated when braided hemp or flax was used to make the pistons steamtight. When the steam engine first came into use good mechanics were scarce, and the engineers of that time had to content themselves with crude work. Once when James Watt was supervising the fitting up of the cylinder of a pumping engine, he wrote to Boulton, his partner, that the cylinder was so nearly round he could not put in half a crown between the gauge and the walls of the cylinder.

It was cases of this kind which led to hemp packing. The hemp packing for the piston was a great improvement in its day, but it burned out very readily and the inevitable change was made to metallic packing. Early engines used steam pressure ranging from 10 to 50 pounds. The high steam pressure soon drove fibrous packing out of use.

Flax and hemp make fair packing for piston valve stem and they are still used on a great many engines. The men who have engines built with stuffing boxes made to take in hemp packing are not wise. It has been demonstrated that metallic rod packing is cheaper in the end than fibrous packing. Some kinds of metallic packing are very unsatisfactory, but all of them are better than hemp. Engineers employed on heavy express train service often have trouble with leaky glands with the danger and inconvenience that results therefrom, but we do not hear of any requests to return to fibrous packing. Metallic packing is in harmony with modern ideas and ought to be preferred to fragile material.

Thanks to Mr. Willard.

Mr. John J. Hannahan, grand master of the Firemen's Brotherhood, and Mr. F. N. Gear, a prominent member of the order, visited New York lately, and presented to Mr. Daniel Willard, general manager of the Erie Railroad, a beautifully illuminated address, which reads:

"In the City of Chattanooga, Tennessee, in the highest appreciation of the courtesies extended the delegates and their families, en route to and from their convention, adopted the following:

Resolved: That we extend our sincere thanks to Mr. Daniel Willard, Third Vice-President of the Erie Railroad Company, for the courteous treatment accorded the delegates and their families in furnishing them transportation to and from their eighth biennial convention, held at the city of Chattanooga, Tennessee, in September, nineteen hundred and two. And be it further

Resolved: That Grand Master Hannahan and Grand Secretary and Treasurer Arnold have these resolutions engrossed and personally present them to Mr. Daniel Willard, and that they may be also made part of the printed records of the Brotherhood of Locomotive Firemen as additional evidence of the appreciation in which he is held by the Brotherhood.

W. W. Atterbury.

The prevailing tendency among the owners of railroad property to select managers from men who have passed through the mechanical department, is again shown in the appointment of Mr. William Wallace Atterbury, general superintendent of motive power of the Pennsylvania Railroad, to be general manager of that great system, in place of Mr. J. B. Hutchinson, advanced. Mr. Atterbury is still a young man, only 36 years old, and there is a long career of usefulness before him with the attendant honors. He was born at New Albany, Ind., in 1866, and was educated at Yale. After graduating he entered the Altoona shops as a special apprentice, and a few years later was made assistant road foreman of engines, a very instructive line of advancement. By rapid strides he went through the rising grades in the mechanical department, until he rested for a few years at the head. Now he moves upward again, and will probably reach the president's chair.

W. W. ATTERBURY

The newest phase of strike talk is among the sleeping car porters. They are resenting the growing practice of giving ten-cent tips.

It must be somewhere written that the virtues of the mothers shall occasionally be visited on the children, as well as the sins of their fathers.—*Bleak House.*

Demurrage Charges.

The right of a railway company to exact payment for demurrage on cars is to be tested in court, and while we have nothing to say as to the merits of the particular case in question, it has always appeared to us inequitable that cars should be used by consignees as storehouses, free of rent. The consignee may or may not be ready for his goods when they arrive, but it is generally a matter of importance for railways to get hold of their cars promptly, and at this time when cars are so much in demand, it is simply imperative that no obstacle be put in the way of rapid unloading and freeing of rolling stock. The whole object of the "railway car" is transportation of goods, not storage, and transportation is the thing covered when the freight rate is paid. Storage is entirely outside and beyond the transportation contract, and it is covered by a perfectly legitimate and well-understood charge called demurrage, which is a sort of car rental on the European plan—you pay for what you get—if you keep the car a long time you pay in proportion. If you make a sort of "quick lunch" of it, you don't find the European plan much of a drain on your pocket. The railways are well within their rights in resisting the free lunch counter fiend in any guise and at all times. Much of the existing shortage of cars is due to too much of the free lunch plan.

Sherlock Holmes and Train Speed.

Sherlock Holmes was, on one occasion, able to astonish Dr. Watson with a remarkably close estimate of the speed of a railway train in which both were traveling. Holmes and his friend were journeying from London to Tavistock, the famous English detective having been engaged on the "Silver Blaze" case, which involved the mysterious disappearance of the favorite for the Wessex Cup and the death of the trainer. Dr. Watson, in describing the trip, says: "We had left Reading far behind when Holmes thrust the last of the daily papers under the seat and offered me his cigar case. 'We are going well,' he said looking out of the window and glancing at his watch, 'our present rate is 53 1-2 miles an hour.' 'I have not observed the quarter-mile posts,' I said. 'Nor have I, but the telegraph poles on this line are sixty yards apart, and the calculation is a simple one.' "

In the United States and Canada the telegraph poles are usually spaced 55 yards apart, and on the average the number of rail lengths passed over in 20 seconds gives very nearly the train speed in miles per hour. The mental calculation made by Holmes would have been unnecessary if he had carried one of RAILWAY AND LOCOMOTIVE ENGINEERING speed cards.

The Dimpfel Boiler.

BY C. H. CARUTHERS.

The increased use of coal as fuel, between 1850 and 1860, on locomotives running on the eastern railways of America, led builders and users to seek boilers of types combining large areas of heating surface with rapid evaporating qualities.

This naturally resulted in designers producing a number of different types, some of which were so obviously impracticable that their construction was limited to the model, others passed through a brief experimental stage in actual service, and a few others were used until the materials required renewal, when the "special" features were cut out and the rebuilt boilers were made as far as possible of the standard types. Although it is very probable that much valuable information was obtained through these experiments, and some of the features are now used in modified forms, yet not one of the specialized boilers exists in American locomotive practice.

They are now but a memory, preserved in drawings, and these drawings are principally in old books long out of publication and hidden in remote shelves of libraries, from which they occasionally pass to the ignominious prominence of a place on the bargain tables of second-hand bookstores.

One such volume recently came into my possession under such conditions. It is entitled, "American and European Railway Practice," etc., by Alexander L. Holley.

The boiler illustrated in this article was known as the Dimpfel boiler. Externally, its appearance differed only in two points from other wagon-top boilers. These points were, the peculiar pocket under the smoke-box and the large manhole at the top of the back boiler head.

Internally, the construction was quite the reverse of ordinary types.

A curved crown-sheet with its concave side above was riveted in the usual manner to a back-sheet and to the side-sheets. At its forward end, however, it was riveted to a very slightly curved sheet with the concave side underneath.

This sheet extended forward to the position usually occupied by the front tube sheet. At its sides it was riveted to sheets curved to a circle described from the same center as those of the boiler barrel, but of about 4 inches less radius. This formed a semi-circular combustion chamber, which was attached to the outer shell or barrel by radial stays, and which was closed at its forward end except in the center, where an opening about 6 inches wide extended from top to bottom of the chamber.

The bottom sheet of this combustion chamber was riveted at its rear end to the front water leg of the firebox, which, of course, extended no higher.

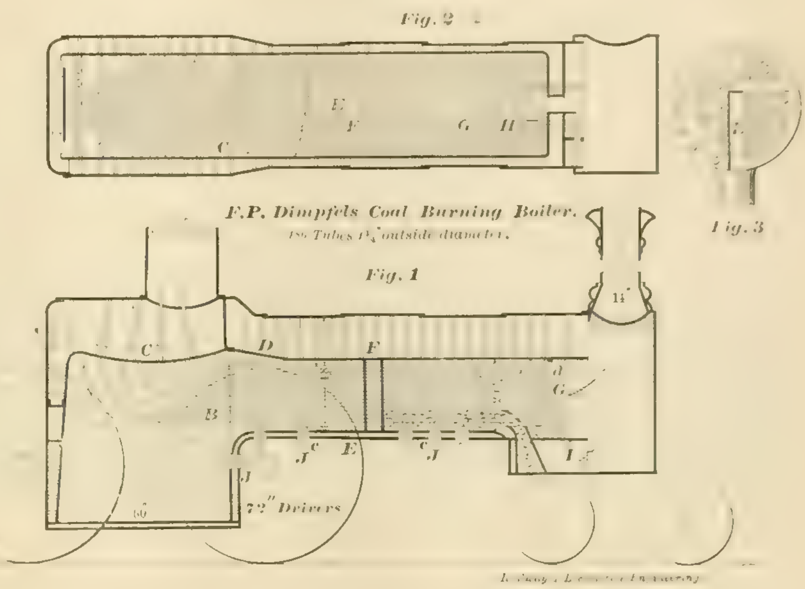
The 6-inch opening in the center of the forward end was riveted to a rectangular flue which sloped downward at the bottom, and at a distance of about 8 inches forward of the chamber was attached to a skeleton tube sheet which was simply a frame containing, besides this flue, openings for two large plates covering space opposite the front of chamber, and for another plate covering opening into boiler-space above the chamber. These plates were bolted to the frame and the upper one contained the opening for the dry pipe, while the other two contained handholes fitted with suitable covers.

The lower sheet of the combustion chamber was cut out for a short distance back of the front and connected to those toward the front amounted to but little.

From the front sheets of the combustion chamber 186 tubes, 1 1-4 inch outside diameter, extended backward to the front of the firebox, where they were curved upward and entered the crown sheet.

It is said that experiments made by placing small pieces of metal in the front of these tubes showed them to have been drawn backward and upward to the crown sheet by the intensity of the circulation. This boiler would undoubtedly steam well, but it was next to impossible to keep the tubes from leaking, while the difficulty of access thereto and the great cost of repairs, combined with some difficulty in maintaining a working water level, forbade their renewal in original form.

Quite a number were in use at one



F.P. Dimpfels Coal Burning Boiler.

a sort of sub-passage, which formed an additional passageway for smoke and gases from the chamber to the smoke box.

From the bottom of this sub-chamber a 6-inch pipe having a trumpet-shaped opening was carried upward and backward to a point about mid-length of the combustion chamber, where it entered a square tube or box standing vertically. The object of this pipe was evidently to admit air to the chamber and it is probable that the vertical pipe or box marked *E* contained numerous perforations, but they are not shown in the drawing. The part *G* would appear to be only a brace or support for the horizontal air inlet, and placed at an angle probably to prevent injury from expansion.

Four openings were provided as shown at *J J* for admission of air to the fire. These and another opening directly in the firebox through its front leg, admitted air in a thin film by means of a sort of valve, but Mr. Holley states that time on the lines now embraced in the P. W. & B. R. R. system of the Pennsylvania, and I have been informed that one or two of these exploded. The Pennsylvania Railroad Company in 1858 sent an 18 x 22 inch Norris engine having 4 drivers of 60 inches and a 4-wheel truck to M. W. Baldwin & Co., to receive a Dimpfel boiler. Baldwins gave it their own construction number of 829, and it was run on the Philadelphia Division until the firebox, etc., were worn out, when its interior was renewed in the standard style, but the large manhole in the back-head remained, and became a puzzle to the younger men who handled it in later years after its running gear had been remodeled in Mogul style and it became a helper on the Alleghany mountains.

This engine was built in 1856 for the State R. R.'s of Pennsylvania, and named "Old Dominion." It came into possession of the Pennsylvania R. R. Co. on August 1, 1857, and was finally retired from service in 1869.

Changes in the M. M. Convention Programme.

At a meeting of the Executive Committee of the American Railway Master Mechanics' Association held at Buffalo on December 10, several changes were made in the list of subjects prepared for discussion at the next convention. The committee decided that there were too many subjects to be reported upon. Previous experience had shown that when many reports were submitted it resulted in stifling the discussions and on that account the number of subjects was curtailed. One subject, "Cost of Running High-Speed Trains," was dropped and several others were consolidated.

The first arrangement called for reports on twelve subjects and two individual papers. The objection was made that members had not time to read so many reports in advance, with the result that none of them were read, and most of the members entered the convention without having any preparation to discuss the subjects that had been under investigation. Even a worse result of superfluity of reports and papers was that insufficient time was left for discussion, and through this the valuable contributions of personal knowledge and experience bearing upon a subject is frequently lost. For several years past the noon-hour discussions of topical subjects has been almost entirely cut off for the sake of saving the time. Any one who cares to turn back and read the noon-hour discussions for five years, beginning with 1895, is certain to be convinced that the association and through it the railway world is losing valuable information by cutting off the noon-hour discussions.

The New York Central Lines in Southern California.

The opening of city ticket offices by the New York Central Lines has been the subject of a great deal of favorable comment on the part of the press and people. The last city office to be opened by these lines is one at Los Angeles, Cal. Mr. F. M. Byron, Southern California passenger agent for the New York Central Lines, will have charge of the new offices, which are situated at 324 South Broadway, Los Angeles.

Squaring the Exhaust with a Plug Rod.

One of our subscribers remarked to me this evening that he saw an article of yours several months ago where a man squared an engine in 35 minutes, but said he beat that. The engine in question was a 17x24, and some time ago broke one of her cylinders in a wreck, and it was bushed to 16 in. A few days ago the nozzle tip was cleaned out; the engine would not steam, and sounded lower. In order to overcome it he put his plugging bar down into the nozzle stand, on the side of the large cylinder (the stand being of the double kind), the engine sounded square thereafter, steamed and he saved himself an engine failure. J. A. B.

Prizes for Essays on Railroads.

The Secretary of the Pacific Coast Railway Club announces that the time for receiving the papers pertaining to the construction, equipping, maintaining and management of steam railways for which four prizes have been offered, has been extended to February 1, 1903, by that time those who wish to compete should have their essays in the hands of Mr. C. C. Borton, 1213 Twelfth street, Oakland, Cal. First prize, $100; second, $75; third, $50; fourth, $25.

Railroad Department of the Y. M. C. A.

The railroad department has seven supervising secretaries. It is influencing the lives of a large percentage of the 1,000,000 railroad men of North America. Seventy per cent. of the railway mileage is contributing to the support of 170 railway associations, having 237 employed officers and 43,000 members. Ninety buildings, costing $1,300,000, are owned by or set aside for their use and form a permanent endowment of this work. Eighteen buildings were erected in 1902. An active evangelistic work is carried on under two railroad leaders, with marked results, and there has been a steady growth in Bible study and educational work. This work cost last year $417,000, of which railway corporations contributed $205,000.

Before Soap Was Used.

Imagine the condition engineers and firemen would be in if they had no soap to aid water in removing the defilement of grease mixed with all sorts of blackening substances. Yet the use of soap is a comparatively modern luxury. Cleanliness is said to be next in merit to Godliness, and it may be that ancient races were very godly because their opportunities for cleanliness were limited.

The origin of soap dates only from the 16th century. Mention was made of soap being brought to London in 1524. The ancient writers Pliny and Calen mention it as an invention of the Gauls, but no trace of it has been found in records of Greek or Roman life. Pompeii's ruins yield many things which seem quite modern, but no soap has ever been discovered. As a substitute the Romans used oil and clay in their baths. Clay, containing a percentage of fuller's earth, makes a considerable lather, and is a very fair makeshift; therefore they doubtless managed to attain a sufficient degree of cleanliness, especially as they devoted long hours to the bath.

It is supposed that soap originated in Mediterranean Europe, where great quantities of olive oil were produced. Oil, in fact, combined with either soda or potash, makes a passable quality of crude soap, and it is possible that some Italian or Spaniard accidentally hit upon the art of making it by letting his pot of oil boil over and mix with the wood ashes of the fire. Ashes contain potash enough for the purpose, and are still used in country places for the manufacture of home-made soft soap.

A Good Cinder Washer.

There is a cinder washing machine in the C. & N. W. Ry. shops at Chicago which has gained the nickname of the "Klondyke," as it is, in a sense, a gold recoverer for the company, though the metal it washes out is brass. The machine which stands in the brass foundry consists of a pair of cast iron cylinders each about 40 ins. in diameter by 12 ins. long. These are rotated by belt and pulley and are fixed on a shaft parallel to the cylinder axis, so that they revolve just clear of a large tray which rests on the floor. The outer head of each cylinder has a circular opening 8 ins. in diameter, through which a water pipe discharges. The lower portions of the cylinder are therefore constantly full of water which comes out of the large circular opening as fast as the pipe feeds in. There is therefore a constant flow of water kept up all the time. Dust, cinders and shop-floor débris is periodically swept up and shoveled into the cylinders. The portion of the mass of rubbish which sinks to the bottom, usually contains small particles of brass which have been spilled on the floor whenever the crucibles are lifted or carried. These small particles generally adhere to bits of cinders or other light bodies, which latter, if free, would float on the surface of water. The mass of brass and cinders immersed in water is carried back as the cylinders roll over, and when the angle of rest is passed it slips down and keeps on rising and slipping in the revolving cylinder. In this way the lighter foreign matter is freed from the brass, and floating to the top, it is eventually washed out into the tray, while the brass particles remain rolling over and over until the operation is completed. The water in the tray is kept drained off, leaving a shallow deposit of mud behind. It is true, as Shakespeare says, that "all that glisters is not gold," but in this case the constant collection of the brass-laden cinders from the shop floor, and the separating out of the metal day by day is made to yield the equivalent of gold to the company. The return, by this method of saving, is said to be something substantial in the course of a year.

The Death-Dealing Street Car.

It is reported that Mr. C. B. Barnes, railroad commissioner of New York, has made the assertion that for the last three years the street railway lines have averaged an accident for every ten miles owned by them with a ratio of one killed and six wounded.

If the same proportion of persons were killed on steam railroads the annual slaughter would be about 20,000 and the wounded about 100,000. He showed that the greatest number of accidents resulted from rear-end collisions, the rear car neglecting the requirement of safety in keeping a proper distance from the one ahead of it. The next cause for disaster was head-on collisions or collisions at intersections. In addition to these he enumerated the killings and woundings at grade crossings, those resulting from the disregard of orders and signals, the want of adequate brakes and the general lack of discipline on the part of the working force.

The Baldwin Locomotive Works' Unit System of Production.

The Baldwin Locomotive Works people have an excellent way of getting the actual cost of each engine they build, which they speak of as "unit system of production." Two sets of books are kept—a financial and a manufacturing. In the financial department accounts of sales, purchases and expenditures appear. In the manufacturing books a separate account is opened for each locomotive, and material and labor are charged against the engine they belong to. At the end of the year these two sets of books must balance each other. It is upon this unit system, which preserves the identity of each engine, that the organization of the labor and the management of the work is based.

About 13,000 men are on the pay rolls of the Baldwin Works at present. Wages are reckoned by the hour. Piecework wages for convenience of accounting are equated to a per-hour rate. A pieceworker can earn the equivalent of from 18 to 50 cents an hour, the average being 30 cents. The unskilled worker averages 16 cents per hour, and all hands are paid every Friday. Payment is made in coin so as to insure accuracy. The shops run continuously 23 hours a day, with a day and a night force. Rigid inspection of work is maintained, and damage for spoiled work is charged to the workman unless occurring from a reasonable cause. A man accepting a piece of work from a fellow-employee in order to finish it, is held responsible for any errors in the work of his predecessor. A workman whose machine breaks down through no fault of his own receives a per-hour rate proportionate to his piecework rate, at the discretion of the foreman.

In the Baldwin Works there is piecework proper, where the workman is paid according to the quantity produced, and there is also the contract system, where sub-foremen, called contractors, execute a portion of the work on a locomotive. The contractor is paid for the job, but the firm pays directly each workman for his labor on the job. The contractor cannot, therefore, get more than the amount due him on any one job by curtailing the wages of his labor. Being paid by the job, he has an incentive to see that his men do their best.

The accurate knowledge which this firm obtains of the actual cost of every piece of work done by the unit system enables those in authority to make stable piecework prices.

The Sederholm Boiler.

The Sederholm boiler is practically a standard horizontal tubular boiler, modified so as to meet the exacting requirements of modern practice with high steam pressure. The tubular part of the boiler is of large diameter, and is connected on the under side with four horizontal drums, the axes of which run at right angles to the direction of the longitudinal axis of the main boiler. Each drum has three connection pipes of ample size, and these provide for free circulation of water. The drums are made out of thinner sheets than those used above, in order to readily transmit heat. The ends are made convex, so that staying is unnecessary. Each drum has a man-hole in one end to facilitate cleaning. These drums stand about three feet above the grate bars, and are so placed that a bridge wall is built between the last two.

The main boiler has two nests of tubes, with space between them to assist free circulation. Above the tubes the round heads are stayed by longitudinal rods, with nuts on outside and inside of each end sheet. The support of the Sederholm boiler is entirely independent of the brick walls of the furnace. It is carried on a steel and iron structure, made up of four cast columns and two heavy I-beams. The boiler rests upon appropriately shaped supports, the back one is fixed to its girder, while the forward one carries a set of rollers to allow for expansion.

The Allis-Chalmers Company are the makers, and they have issued a neat little pamphlet giving full description and data concerning the boiler. The company will be happy to send a copy to any one sufficiently interested to apply, Twelfth street and Washtenaw avenue, Chicago, Ill.

WESTERN OHIO ELECTRIC OVERHEAD CROSSING C & E RAILWAY

An Interesting Optical Illusion.

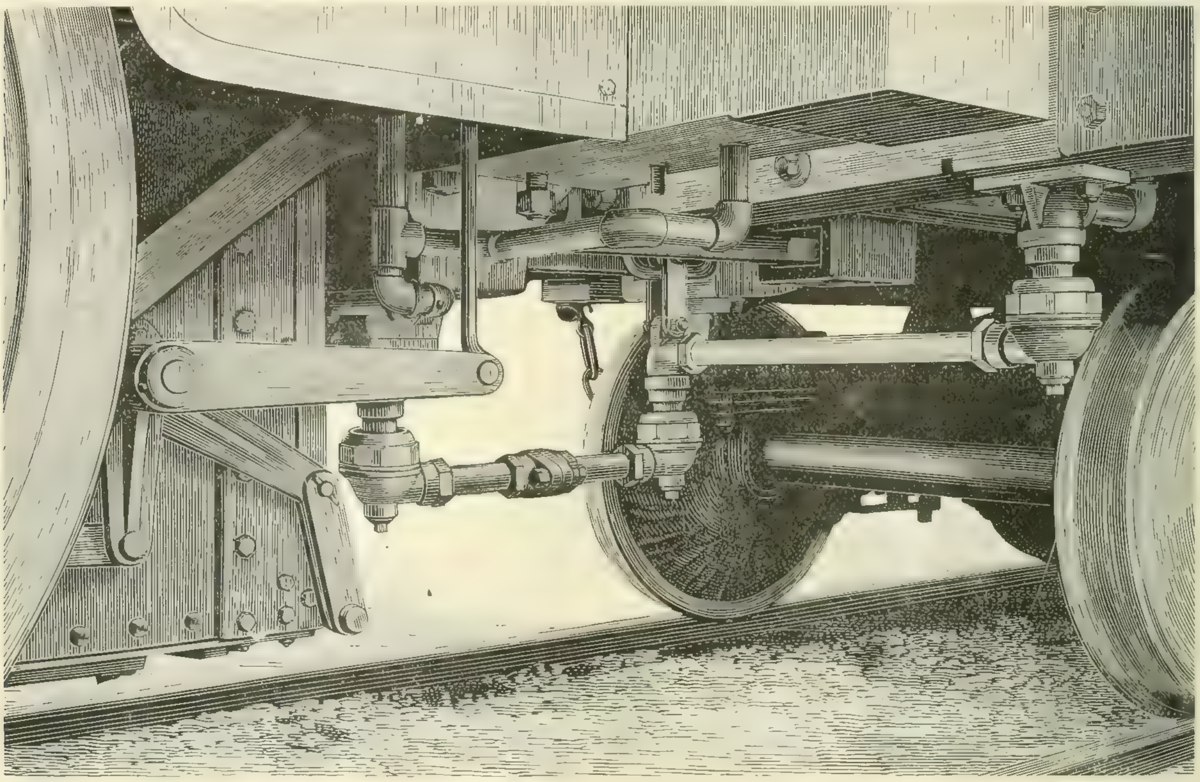
We hear that great preparations have been made for holiday entertainments at the Proctor theaters in New York, Albany, Newark and Montreal, and our many railway friends who have to travel to any of these cities on business and stay over night may spend a very pleasant evening in the enjoyment of various forms of dramatic art. Talking of art, moving pictures form one of the many features presented at these high-class places of amusement. A most curious appearance may once in a while be noticed by the observant spectator. It occasionally happens in these pictures that the wheels of a hansom or a fire engine or other vehicle look as if they were revolving backward, when the vehicle is advancing rapidly. That this is not a defect in the wonderful projecting machine called the Kalatechnoscope, may be known from the fact that a spoked car wheel, if viewed by the light of a series of lightning flashes, would present the same appearance. The explanation is that the photographing machine which takes the negatives for moving pictures does so at regularly spaced intervals of time. An example will make the whole matter clear. Suppose the wheel spokes to stand in the position indicated by the figures on a clock dial, when No. 1 picture was taken, and suppose that they all advance a distance ex-

actly equal to the five-minute space when No. 2 picture was taken, and so on, all around the clock. It is obvious in this case that the wheel would not appear to revolve at all. If, however, with same time intervals, the 12 o'clock spoke moved over only four minutes' space, and all the others covered the same distance, and were photographed in that position, and if at the next exposure the 12 o'clock spoke stood at 8 minutes past, with all others having made a similar advance, we would apparently behold the strange spectacle of a wheel turning slowly on a rapidly driven vehicle and revolving in a direction opposite to that in which we know it to be moving. The same appearance may be observed with the spoked wheels of an electrically driven street car when a series of regular sparks flash between rail and wheel. It is a curious illusion and one which requires keen observation to detect, though it does not detract from the general life-like effect produced by the shifting scene. It would be worth while for any one to indulge in a pleasant test of his powers of observation by attending one of the Proctor entertainments and closely watching the Kalatechnoscope pictures.

The Moran Flexible Joint.

The question of flexible metallic connections for conveying steam, air or liquids is receiving considerable attention. Pioneers in this line, are the Moran Flexible Steam Joint Co., Louisville, Ky., manufacturers of a ball and socket joint, whose simplicity of construction goes beyond any device so far invented. It is made with only three parts, ball, bell and ring, without gaskets, packing or springs to make it tight. For steam, air or pressure work of any kind it has a certain play between the parts, and is seated and made tight automatically the instant pressure is applied. Steam acts both as a cushion and lubricant to ball part, which soon becomes practically case hardened, and instead of wearing out, it constantly reseats itself. It has a full, open passageway, and is so constructed that when moved or turned at an extreme angle in any direction, the passage is of equal size to the pipe.

Fig. 1 shows a special angle joint which is being extensively used as a steam heat connection between engine and tender; its application for this service is shown by Fig. 2. It has an automatic drain or drip, to prevent freezing of connection. It is sold with a time guarantee, which makes it most economical in point of long and reliable service as compared with any other connection on the market.



MORAN FLEXIBLE JOINT. FIG 1.

By its use repairs at inopportune times and places are eliminated, hence delays from this source are reduced to a minimum, which is a most important feature in railway equipment of any kind.

The Moran joint has long since passed the experimental stage for this service, it having been in daily use on the following railroads: Pennsylvania and branches, Southern, Baltimore & Ohio, Chicago & Northwestern, Chicago, Milwaukee & St. Paul, Northern Pacific, and also by the Baldwin Locomotive Works and the American Locomotive Co.

The application of this joint for air-brake connections is also worthy of careful consideration. Any desired pressure may be carried with absolute safety and reliability in air-brake service.

For high-pressure connections to compressed air locomotives, motors, etc., it has become a standard by the largest manufacturers of such machinery, which includes the H. K. Porter Co., Pittsburg, and American Locomotive Co., Dickson Works, Scranton, Pa.

The Moran joint is made with close bearings for conveying liquids or gases, under little or no pressure, and is a factor for fuel oil connections between engine and tender. It can be used with loading and unloading connection to tank cars, oil steamers, barges, etc. The steam joint is also used to advantage for connections to steam shovels, rapid unloaders, pile drivers, pneumatic hoists, rock drills and similar machinery. It is made by the Moran Flexible Steam Joint Co., Louisville, Ky., and is furnished on approval where practical tests are wanted.

Duty. Begin it early, and do it well; and there is no antecedent to it in any origin or station, that will tell against us with the Almighty, or with ourselves. —*Little Dorrit.*

Playing an Air on the Whistle.

Men have mastered the clarionet and tortured the trombone, fretted the flute and murdered the French horn, but a Richmond man can play an air on the whistle of a locomotive.

As the 7:45 pulls out from the Southern Depot one may hear every night the air "There's a Land Fairer Than Day." With his hand on the throttle, as the engine swings into the darkness, the engineer plays, with the skill of a trained musician, the opening bar of the old song. It is his parting salute to his sweetheart. The above was considered of sufficient importance to be telegraphed to the New York *World*.

"Natural Knowledge" of Use in the Brass Foundry.

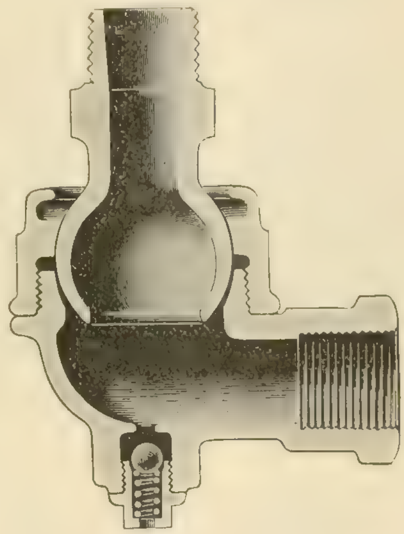
Lead is acknowledged to be an ideal metal as far as anti-friction is concerned, but it is entirely too soft to be of any use as a journal-bearing metal alone. Copper and tin, when alloyed together, make a bronze capable of sustaining weight, but have very poor anti-friction qualities. A satisfactory combination of these weight-sustaining and anti-friction properties, has been achieved in what is called Cyprus Bronze, made by the Brady Brass Company, of New York and Jersey City. The island of Cyprus, by the way, is where the ancients originally discovered copper, and the Latin form of the word used to designate this island in the Mediterranean, is the one from which the name copper is derived. Cyprus bronze as made to-day is a copper-tin-lead alloy, which contains as much as from 15 to 32 per cent. of lead, according to the kind of service for which the bronze bearing is adapted. This is a great deal of lead for any such alloy to carry, without segregation taking place, and it is to the successful accomplishment of this adjustment that scientific knowledge has been applied.

In making these bearings, therefore, a large quantity of anti-friction metal has been introduced into an alloy which already has weight-sustaining qualities, and the lead is so introduced that each function is, so to speak, evenly distributed through the resulting mixture.

The proportions of the constituents undoubtedly play their part; the order of mixing has an important influence in producing the desired result; but the makers rely principally upon their own observation of the fact that the introduction of a particular flux into the molten mass, at a particular temperature, produces a bronze which consists of an exceedingly intimate mixture of very fine particles of copper, tin and lead, in which there is absolutely no grouping of elements. It forms a homogeneous metal, exhibiting a close grained fracture, with hardly any perceptable shrinkage in cooling. This Cyprus bronze is, therefore, nothing more or less than a carefully compounded alloy, which contains more lead than is usual in journal bearings, and holds it most minutely and evenly distributed in the whole mass. It is everywhere, and all through the compound, each particle of the anti-friction lead is surrounded or supported, if one may say so, by weight-sustaining copper and tin, and this product is said to give excellent results in railway service. It is a journal bearing made by the application of what the late Prof. Huxley called "natural knowledge," or in other words, knowledge of the secrets of nature, which is gained by close observation, patient experimenting and correct reasoning. The works of the Brady Brass Company are at 200-208 Tenth street, Jersey City.

Do You Want Books?

If you do the Book Department of Railway and Locomotive Engineering will furnish you with anything in print, no matter what department of literature it belongs to. We can procure you anything from a family Bible to the latest novel, but our specialty is railway, mechanical and engineering books.



MORAN FLEXIBLE JOINTS.—Fig. 2.

A year's subscription to Railway and Locomotive Engineering costs only $2.00, and the paper is a welcome visitor, especially where there are children.

"The World's Railway" is a most interesting history of railways and locomotives. It is beautifully illustrated and the net price used to be $10.00. We now give it and a year's subscription to Railway and Locomotive Engineering for $5.00.

"Locomotive Engine Running and Management," by Sinclair, is an old and universal favorite. A well-known general manager remarked in a meeting of railroad men lately, "I attribute much of my success in life to the inspiration of that book. It was my pocket companion for years." Price, $2.00.

"Practical Shop Talks." Colvin. A very useful book combining instruction and amusement. It is a particularly useful book to be in the hands of a young mechanic. Has a stimulating effect in inducing young men to study their business. Price, 50 cents.

"Examination Questions for Promotion." Thompson. This book is used by many master mechanics and traveling engineers in the examination of firemen for promotion and of engineers likely to be hired. It contains a wonderful amount of information about the locomotive in small compass. Convenient pocket size. We cordially recommend this book. 75 cents.

"Compound Locomotives." Colvin. A little study of this book will instruct a man so that he will understand the construction and operation of a compound locomotive as well as he understands a simple engine. Tells all about running, about breakdowns and repairs. Convenient pocket size, bound in leather, $1.00.

"Standard Examination Questions and Answers on the Air Brake." Formulated and adopted by the Air Brake Association, being a book of nearly 700 authors. Brought right up to date. All about air brakes, both Westinghouse and New York, their construction, operation, disorders, symptoms and cures. Most complete book on air brakes yet printed. Will pass you through anybody's air brake examination. 135 pages, 6 x 9 inches, containing nearly 1,000 questions with their answers and nearly 100 illustrations. Postage prepaid, 25 cents.

"Catechism of the Steam Plant." Hemenway. Contains information that will enable one to take out license to run stationary engine. Tells about boilers, heating surface, horse power, condensers, feed water heaters, air pumps, engines, strength of boilers, testing boiler performances, etc., etc. This is only a partial list. Question and answer style. 128 pages. Pocket size, 50 cents.

"Care and Management of Locomotive Boilers." Raps. A book that ought to be in the hands of every person who is in any way interested in keeping boilers in safe working order. Written by a foreman boilermaker. Also contains several chapters on oil-burning locomotives. 50 cents.

"Locomotive Link Motion." Halsey. Any person who gives a little study to this book ceases to find link motion a puzzle. Explains about valves and valve motion in plain language easily understood. $1.00.

"Machine Shop Arithmetic." Colvin and Cheney. This is a book that no person engaged in mechanical occupations can afford to do without. Enables any workman to figure out all the shop and

machine problems which are so puzzling for want of a little knowledge. 25 cents.

"Firing Locomotives." Sinclair. Treats in an easy way the principles of combustion. While treating on the chemistry of heat and combustion is easily understood by every intelligent fireman. 50 cents.

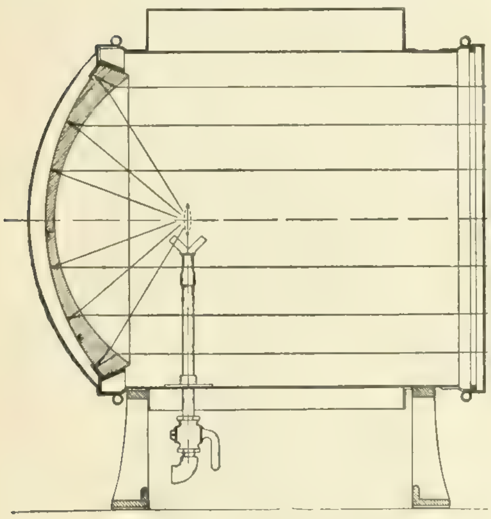
"Air-Brake Catechism." Conger. Nothing better can be found for people trying to learn all about air brakes. Tells the whole story. Cloth, 75 cents. Leather, $1.00.

"Skeevers' Object Lessons." Hill. A collection of the famous object lessons which appeared in this paper several years ago. They are interesting, laughable and best of all are of practical value. $1.00.

"Stories of the Railroad." Hill. Best railroad stories ever written. Those who have not read these stories have missed a great literary treat. $1.50.

"Block and Interlocking Signals." Elliott. Tells what signals are, what they do and how they do it. Comprehensive treatise on the subject. Ought to be studied by all trainmen where block signals are used. $3.00.

RAILWAY AND LOCOMOTIVE ENGINEERING. Bound volumes. $3.00.



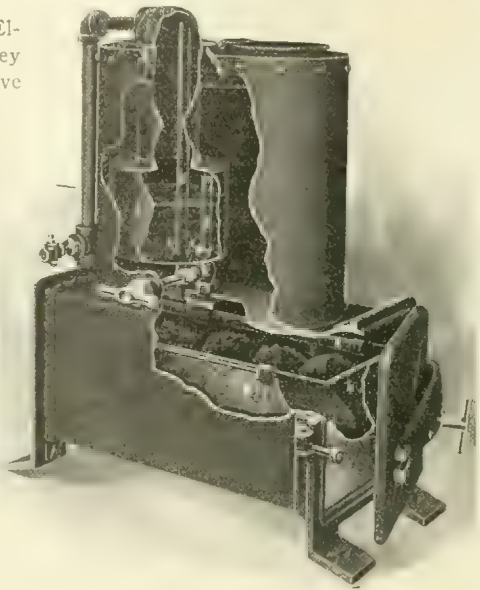
MANGIN LENS REFLECTOR.

The Searchlight Principle Applied to Headlights.

The locomotive headlight in general use to-day appeared to Mr. S. W. Rushmore, of the Rushmore Dynamo Works, Jersey City, to be simply a primitive searchlight, and as such, capable of considerable improvement. With this end in view, he used what is technically known as a Mangin lens in the construction of an acetylene gas headlight, which has met with gratifying success wherever tried.

The Mangin lens is a mirror as well, and the principles of refraction and reflection are made use of in distributing the rays, which leave the lamp in a powerful beam of intensely white light. A 1 ft. burner, rated at 70 candle power, throws a clear, even beam, which covers the entire right of way for 1,500 feet, or more, and the spreading is just sufficient to enable an engineer to see the track ahead when rounding curves.

A singular fact about this light is that it is not blinding. One may look into it at any distance and see the ties right up to the engine. This is thought by the makers to be due to there being no unevenly lighted areas in the lens, which would throw small, intense shafts of light ahead. A further probable explanation is that the non-blinding property of the light is simply due to its quality. The acetylene flame is exceedingly white, and the approximation to the quality of sunlight is very close. This is proved by the fact that the delicate shades and tones of color retain their quality and value under it, as in daylight.



SECTION OF GENERATOR

In operation water passes to the spray pipe *B*, by flowing up the casing *C*, which hangs from the roof of the upper chamber and reaches the openings in pipe *d*. When gas is given off it rises in pipe *e*, and goes to the lamp through a pipe which opens into the top of the hanging casing. If gas accumulates faster than it is used it depresses the water level below the perforations shown, and water ceases to flow to the spray pipe *B* until the consumption of gas permits the water to rise again and spray the calcium carbide. This automatic regulation of the gas is economical and safe, as it prevents undue accumulation of pressure. In the event of excess accidentally arising, the water would be simply backed out of the hanging casing, and the gas would harmlessly escape in the atmosphere.

A simple method of keeping the water from freezing has been borrowed from the water heater usually attached to the humble cookstove of household use. A

U-shaped copper pipe, which has its round end inserted a few inches into the smoke-box, is attached to the water holder, but the upper ends enter, each at a different level. This insures circulation and keeps the water warm. In summer the U-shaped pipe can be shut off. The generator supplies light for 48 hours, and the cost of the "carbide" is about three-quarters of a cent per hour.

Grand Trunk Wants to Transfer Locomotives Into United States.

One of the agents of the Grand Trunk Railway has applied to the Treasury Department for permission to import into this country free of duty eleven foreign-made engines to be used temporarily between Island Pond and Portland, Me., for the extraordinary traffic caused by cattle shipments at the season of the year. After consideration in the customs division it has been decided that the law requires a duty of 45 per cent. on all foreign engines imported to run within the limits of the United States. This declaration was based on paragraph 193 of the Revised Statutes, including articles not specifically provided for in the tariff schedules. It is estimated that the value of these engines is about $20,000 each, and the total duty to be required of the Grand Trunk Railway will be approximately $100,000. According to officials of the customs divisions it is permissible to drive a foreign-made engine across the boundary line to a point in the United States and return, but it is unlawful to run engines between two points within the United States.

The American Steam Gauge and Valve Manufacturing Company, of Jamaica Plain, Boston, have issued a very artistic calendar for 1903. The picture which, of course, constitutes the attractive feature, represents a very interesting and humorous scene, a little girl and a Gordon setter from the *dramatis personæ*. Perhaps a "pointer" would have been a more appropriate animal for a steam gauge company to employ, but the selection is eminently satisfactory as it is. The picture shows the dog laid out on an improvised bed on the lawn with a blanket thrown over him. A sweet little girl, watch in hand, is holding his paw and endeavoring to feel his pulse, while a tumbler and spoon and a bottle of medicine are close at hand. The company are prepared to send this calendar to those who, according to ordinary business ethics, are entitled to it.

The Joseph Dixon Crucible Co., of Jersey City, have issued a pocket card with a revolving disc on the back. An opening in the card shows about one-quarter of the disc, and on the disc are the four colors of Dixon's silica-graphite paint. This little device enables one to see the effect of any given color without the distraction caused by the presence of another. The paint referred to is used for the protection of steel bridges, steel cars, metal roofs, smoke stacks, boiler fronts, coal pockets, trolley poles and exposed metal of all kinds. The Dixon people also publish on a separate card a letter from an electric light company regarding a tall smoke stack which was painted some years ago with silica-graphite paint. They call this a "stack reference," but it is quite certain that they have received a stack of such references. Write the Joseph Dixon Crucible Co. for particulars.

The Chicago Pneumatic Tool Company have issued a catalogue of the air compressors manufactured at their works in Franklin, Pa. The book contains the latest types of compressors and has a very complete illustrated description of the chief features of each design. The half-tones are excellent and the catalogue presents a very attractive appearance. All data pertaining to standard styles is also included. An article on the uses of compressed air, and information relative to the proper installation of compressed air equipment are to be found in this publication. The catalogue will be sent by the company to those who are interested enough to apply for it. The New York office is 95 Liberty street.

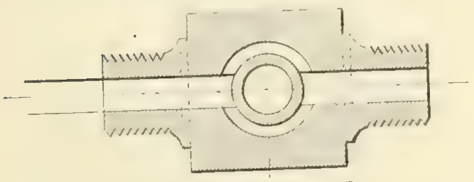
If the New York Central's Empire State Express were an official instead of being rolling stock, she would surely get the big head—she gets so many honors. The latest feather in her cap is that her name is used in playing football, in which it becomes an adjective. One of the popular plays in the Yale-Harvard game was called the Empire State Express play, a play that is swiftest of all, sure to get there and right on time.—*Millerton Telegram.*

We are informed that the United States Government ordered from F. W. Bird & Son, East Walpole, Mass. (makers of "Neponset Papers" and "Paroid Roofing"), 1,200,000 square feet of the latter for immediate shipment to Manila, Philippine Islands. The amount, designed for army barracks and other Government uses, is sufficient to cover 27 acres of roofs, and is undoubtedly the largest shipment of roofing ever made.

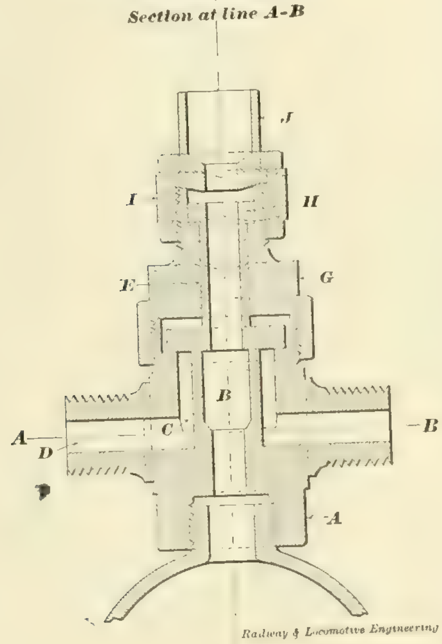
The bound volume of RAILWAY AND LOCOMOTIVE ENGINEERING is now ready for delivery. It is bound in very substantial shape and cost three dollars. Write to 174 Broadway, New York.

Improvement for Sight Feed Lubricators.

The annexed engraving shows a device for improving the sight-feed lubricator now used for cylinder lubrication on locomotives. The difficulty with the present lubricator is that the oil passing through the sight-feed glass collects into the long pipe connecting to the steam chest and stays in this pipe until the steam is shut off or else the conditions become more favorable for a continued flow. If a current of steam could be made to flow continuously through oil-conveying pipe in direction from the lub-



Section at line A-B



Railway & Locomotive Engineering

ricator to the steam chest, then the oil could not accumulate in this pipe, and the difficulty in regard to this point would be overcome.

The device shown on enclosed blue print is intended to be applied to any lubricator condensor for the purpose of supplying live steam from the boiler through the oil pipe to steam chest, this current to be automatically regulated by the steam pressure in steam chest.

The device consists of a cross-shaped piece, A, provided with an interior annular valve seat (B), the steam space C and the pipe connection D conveying the steam to the oil pipe, which receives the oil from the lubricator. The upper part of this cross-shaped piece is bored out to form a chamber for the valve E, which extends through the part G, which in its upper end forms the seat for the ring-shaped valve, H. This piece G, takes the nut, I, and nipple, J, which connects steam supply pipe to boiler.

The device operates in the following manner: When steam is turned on to lubricator, the pressure on the ring-shaped valve, H, will keep this valve closed, and also the valve E. When throttle is opened and steam chest filled, the oil pipe will also be filled to about the same pressure as may exist in steam chest, and as the area on valve E exposed to this pressure is larger than the valve H, on which the live steam acts, the valve E will leave its seat, allowing the live steam to pass over the seat B into the steam space, D, and continue to steam chest, this current continuing as long as steam pressure in chest keeps the valve E open. By giving the areas of the two valves, E and H, proportions in relation to the difference of pressure in steam chest and boiler, the valve E can be made to lift at any given pressure in steam chest and thereby admit live steam into the oil pipe producing the desired current and the consequently following continuous lubrication of slide valves and cylinders.

T. J. BUCKLEY.

December Book of the Royal Blue.

"Annapolis in Colonial Times," an article illustrated by photographs of colonial residences still preserved in the historic town, is made a feature of the December number of "Book of the Royal Blue," published by the passenger department of the Baltimore & Ohio Railroad.

Pictures of the Jennings place, Harwood mansion, Paca residence and the Chase home appear among the illustrations. A description of the new series of postage stamps bearing reproductions of Gilbert Stuart's "Washington" and the "Stars and Stripes," and an article on the "Pantheon of America," go to make the book a colonial number that will doubtless be much sought after.

"Fortunately this company has never been able to pay dividends, so its stockholders will not be disappointed." That was the satirical answer made by President Ramsey to a committee of employees demanding more pay and intimating the alternative of a strike. That seemed rather a conclusive dictum, but on the other hand the employees are not to blame for the property not paying dividends, and they are entitled to the wages paid by other companies for similar service.

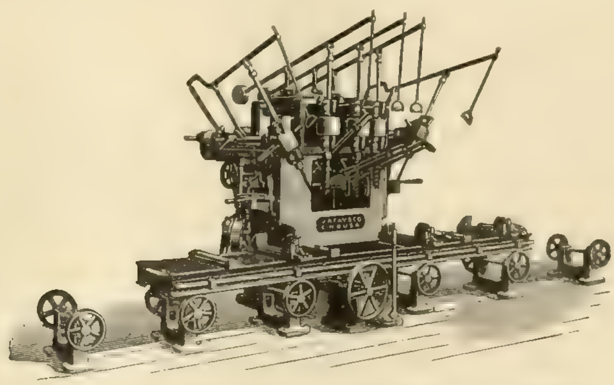
Mr. James C. Clark, president of the Mobile & Ohio, and one of the most widely-known railroad men in the United States, died at the home of his daughter from Bright's disease. He was 79 years of age.

Canadian Pacific to Adopt the Pension System.

In establishing an old age pension system for its employees the Canadian Pacific Railway Company has given another proof that its reputation for business wisdom is not undeserved. The president of the C. P. R. says in his circular, it builds up among the employees a feeling of permanency in their employment, an enlarged interest in the company's welfare, and a desire to remain in and devote their best efforts and attention to the company's service. That these results will be obtained there can be no doubt, for the plan appeals to the strongest human motives, and unites the interests of all connected with the company by making every man in its employ feel that his welfare is part of its system.—Montreal *Daily Witness.*

No. 5. Vertical Car Borer.

An improved machine, especially adapted for heavy boring in wood in car shops, shipyards, and other places where large timbers are worked, is shown herewith. Its makers have spared no time or pains to embody in its construction such new points and improvements as would enable it to successfully meet the most particular requirements of those for whom it was designed, and it is offered to their consideration with the feeling that it will prove of interest.



No. 5. NEW FIVE-SPINDLE VERTICAL CAR BORER.
(Pat. Jan. 30, 1900; Feb. 6, 1900.)

The capacity of the machine for boring large holes has been greatly increased, and every convenience has been incorporated to make the boring easily and quickly done.

The spindles are of improved construction, the outside boring ones have angular adjustment of 45 degrees inside and 60 degrees outside. Material 14 inches square can be bored; the spindles will travel 13 inches, and the vertical movement of end spindle frames is 8 inches. The outside spindles can be instantly placed at any angle desired; there is no strain, and short bits can be used with facility.

The table is a steel traveling carriage of any length desired, is provided with necessary stops, and has a device for firmly clamping the stock. It has rack and pinion feed under instant control of the operator, and has connections for making fine adjustments. When desired a stationary table 9 1-4 feet long, with nine rolls, can be furnished.

A supplemental under boring spindle, especially useful for boring coal car sides, can be furnished, boring independently or at same time as upper spindle, and short bits can be used to advantage. This improvement will prove very beneficial to all those who make such cars.

The makers, J. A. Fay & Egan Co., of Cincinnati, O., will furnish those interested with further particulars, cuts and terms, and will send free their new catalogue to those interested who will write for it, mentioning RAILWAY AND LOCOMOTIVE ENGINEERING.

The Protectus Company, of Philadelphia, have issued a very well illustrated catalogue in which the merits of the preservative paint known as "Protectus" are duly set forth. The claim made for Protectus is that the vehicle which carries the pigment is itself preservative. Among the half-tones with which the pamphlet is illustrated, we notice the Memorial Hall in Fairmount Park, Philadelphia, the roof and iron work of which are painted with Protectus. This building was the Art Gallery in the famous Centennial Exhibition of 1876. The trolley bridge in Fairmount Park is also shown, and some oil tank cars, to which this covering has been applied. Protectus can also be used on the front end of locomotives, and a special kind of this material has been prepared for use as an insulator for electrical connections. The corrosive effect of salt water and the drippings from refrigerator cars can be successfully resisted by this medium. The catalogue may be obtained upon application to the company.

If you want any book, be it poetry or prose of any kind, this office will supply it.

Enlarging Juniata Shops.

The Pennsylvania Railroad Co. are doubling the capacity of their locomotive building shops at Juniata, and a large number of workmen are already engaged on the new building. When the Juniata shops were first built they were a model of modern locomotive building shops with all the latest tools and appliances then on the market. The new shops under construction will contain the best tools that can be procured, which will be driven by electric power.

It will be a very interesting comparison to go over the old shops and compare them with the new ones. It will give a very good idea of the progress made in manufacturing appliances for locomotive use in the last ten years.

The Cincinnati Milling Machine Company, of Cincinnati, Ohio, have just issued an illustrated catalogue which they call a "Treatise on Sharpening and Grinding." Its pages are devoted to the description of the Cincinnati universal cutter and tool grinder, which is used for sharpening and grinding milling cutters, reamers and other tools. After a general description, some directions and tables, each subsequent page contains a well-executed half-tone, clearly showing the grinder at work on some particular cutting tool, with description of the operation below. Several pages follow, showing the great variety of pieces which the machine will grind, the emery wheels used in the grinding and the counter-shaft connections for the grinder. The company will be happy to send the "treatise" to any one sufficiently interested to apply to them for it.

A very handy "Index and Abstract of the Master Car Builders' Rules and Decisions" has been issued. It is intended to be carried in the book of interchange rules for reference, as it contains a most useful index and a list of the changes made in the code, together with a brief abstract of the decisions of the Arbitration Committee. The cases are cited, each in a line or two and all the essential information is given. The work of indexing and condensing has been done in a very creditable way by Mr. J. D. McAlpine, of the L. S. & M. S. Ry., Cleveland, Ohio, and the pamphlet is given away with the compliments of the McConway and Torley Company, of Pittsburg, Pa., the makers of the Kelso coupler.

Several western papers contain advertisements asking trainmen to send 25 cents for an examination blank, with the pretense that the parties supplying the blank can provide positions for competent men. We advise our readers to keep their money. The thing is a humbug.

It was expected that the agreement made by the Eastern Trunk lines for last year abolishing exchange passes would not be renewed for 1903, but at a meeting of the presidents last month the agreement was renewed, and it is expected that it will be further extended this year. The agreement has excited a great deal of discontent among certain classes of railway employees, but there is no prospect of passes ever being so freely given as they were before 1902.

Stannard & White, the well-known makers of cab seats, have removed from Appleton to Racine, Wis., where they have consolidated with the Gold Medal Camp Furniture Company. This change has been made necessary by the increasing business which the firm are enjoying. Under the new arrangements the cab seats, which have made Mr. Stannard known all over the country, will be manufactured as well as his numerous other railroad inventions.

The Atlas Car and Manufacturing Co. have issued a couple of catalogues, Nos. 1008 and 1012, which show a partial line of cars made at their works at Cleveland, Ohio. The first of the catalogues deals with the cars which are made for use around brick yards and cement plants. The second exhibits equipment constructed for industrial railways. Good half-tones show the cars, and each is described and numbered for reference. The catalogues will be sent free to those interested enough to write to the company for them.

"Hard Water Made Soft" is the name of an illustrated catalogue recently published by the Industrial Water Company, 126 Liberty street, New York. Besides illustrating a variety of apparatus used in removing scale-making impurities from water, the pamphlet gives some interesting information about boiler feed waters. People interested ought to send for the catalogue.

We have been informed that the Q and C Company shipped from their factory at Chicago Heights one of their largest special metal sawing machines consigned to the United States Government, to be used at the Cavite Navy Yard at Manilla.

Seventy-three all-iron flat cars have been shipped to Newfoundland. They were made at Berwick, Pa., the iron for their manufacture being imported from Newfoundland in pigs, paying a duty of $4 a ton. Now that this iron has been made into cars, the manufacturers are entitled to an export drawback of $3.96 a ton. The cars weigh 30,000 pounds each, and are consigned to the Northumberland Railroad Company, Newfoundland.

Class C. S. C. Air Compressor.

A new type of air compressor, built by the Chicago Pneumatic Tool Company, represents the latest product in this field, and is designed to meet the growing demand for higher efficiency in air compression. It is known as the Class C. S. C. pattern, designed for a delivery air pressure of 100 lbs. per square inch, with a steam pressure of 100 to 150 lbs. The compressor has L. P. steam cylinder, 31 ins. diameter, H. P. steam cylinder 20 ins. diameter, L. P. air cylinder 28 ins. diameter, and H. P. air cylinder 16 1-2 ins. diameter, all cylinders being 24-in. stroke. The capacity of the compressor is 1,710 cb. ft. of free air per minute when operated at 100 revolutions, or 2,052 cubic feet at 120 revolutions.

In design, the frames follow the most approved Corliss construction and are of exceptional strength. The steam and air cylinders are tied tandem to each other, with heavy tie rods. Steam and air pistons are of solid type, cored hollow, and are provided with snap rings. They have no followers or bolts, thus avoiding liability of accident.

Provision is made for a circulation of cold water the entire length of the cylinder, the water passing also through the heads, its cooling effect being especially concentrated around the discharge valves, which naturally become very hot. A novel feature is an outside water connection for conducting the circulation of water between air cylinder and cylinder head, precluding the possibility of serious accident through water entering the interior of cylinder should the gasket between cylinder and head become defective.

The air inlet and discharge valves are placed in the cylinder heads from the outside and are thus immediately accessible for adjustment or repair without the cylinder heads requiring removal. A feature of more than ordinary importance embodied in this valve is the fact that the valve seat is a part entirely separate from the cylinder proper and may be removed, replaced or renewed whenever occasion requires.

The valve seats are of bronze and the springs of steel. The proportion of valve area to cylinder area is exceptionally liberal, enabling the cylinder to fill freely at each stroke. The cylinder flanges are recessed to effectually prevent the valves falling into the cylinders, thus avoiding the use of a guard plate, and the consequent clearance loss.

The cranks are of disc pattern, made from best quality charcoal iron. Connecting roads are made from best forged steel, carefully finished. Boxes are adjustable for wear, and accord with the most approved practice. A combined speed and pressure regulating governor is provided, having a connection to the air receiver.

The inter-cooler furnished with this type of compressor consists of a set of tubes encircled by a steel shell, into the heads of which the tubes are fitted, suitable provision being made for expansion and contraction. A constant circulation of cold water is maintained through the tubes, and the compressed air from the initial compression cylinder enters the inter-cooler on one side and after thorough distribution and contact with the tubes discharges from the other side, passing to the next compressing stage. Adequate provision is made for readily cleaning the interior of the inter-cooler, and the tubes, being of composition metal, do not rust or become foul.

This type of compressor is built in three sizes, ranging in capacity from 500 to 2,000 cubic feet of free air per minute, and is also built with simple steam cylinders, for plants where the available steam pressure does not warrant compounding. Single and duplex compressors in a variety of sizes are also manufactured. The compressors here described are in use in the shops of some of the principal railways, locomotive building plants and in large manufacturing establishments.

The Union Pacific Dining Car Menu has found its way into our sanctum, and carries the mind of the editor away from type and galleys proof so that he even forgets the insistent call for "copy." The scene before his mental vision is a table laid with a snowy cloth and covered with shining silverware and sparkling glass, while the warmth and light of the luxurious dining cars on this road contrast strongly and yet pleasantly with the wintry landscape outside as the train flies steadily along the "overland route." There is no bell or gong sounded to announce when the feast is spread, but there is the more gently urgent personal appeal in those musical words, "Dinner is now ready in the dining car." At the top of each card is a view of some important city along the line, with description printed on the back, which the diner may read in the short interval which precedes the enjoyment of "a bird, a bottle and a cigarette."

Wm. C. Baker has obtained an injunction against the Crane Co., of Chicago, and an accounting has been ordered on account of infringing the Baker patent combination cock and filler funnel.

Extract from case respecting the use of a steam engine for conveying coal. August 9, 1814, referring to "Puffing Billy:"

"If the noise of this engine disturbs the cattle grazing in the lands adjacent to the wagon way, so as to injure them with regard to their feeding, I think it may be considered as a nuisance."

In a paper presented to the last meeting of the American Society of Mechanical Engineers Mr. William Kent advocates the use of figures representing resistance instead of conductivity of heat. A table is given, showing the heat resistance of various substances as computed from the conductivity. It is proposed that the co-efficient of heat resistance shall be equal to units divided by the number of British thermal heat units transmitted in one hour, by a slab of one square foot in area and one inch thick per degree Fahrenheit of difference of temperatures between the two faces of said slab, both surfaces being exposed to the still air.

Some trials have recently been made on the line of the South Western Railway of England, with a petrol-driven motor car for inspection of permanent way. A speed of thirty miles per hour was maintained on the level, the car carrying eight passengers. The experiment on the grades encountered were interesting. A rising gradient of 1 in 100 was climbed with eight passengers abroad; another 1 in 50, with five people carried, and 1 in 37 on a curve, was ascended, with three people on the car. All the grades were attempted from a standing start. The car weighed 520 lbs., the motor was a 6 H. P. one, having two water-cooled cylinders and connecting rods driving direct on the back axle. The test was considered very satfactory.

At the last regular meeting of the New England Railroad Club at the Pierce Hall, Boston, a paper on "Electrically Driven Shops" was presented by Mr. Robert L. Warner, Boston, sales manager of the Westinghouse Electric and Manufacturing Company. Mr. Warner's paper was illustrated by a large selection of stereopticon views, showing many examples of the application of direct current and induction motors to the driving of machine-shop tools and other apparatus.

The management of the Michigan Central has gone into the catalpa tree culture, with a view to providing ties and fence posts for all future time. Experiments in planting catalpa trees was made by several railroad companies about 30 years ago, but the thing proved a failure. We do not believe that any ties were made from thousands of dollars outlay.

The Ashton Valve Company, of 271 Franklin street, Boston, have a very neat calendar for 1903. The card is a pleasing tone of gray, with the name of the company, etc., in silver letters. The picture on the calendar is printed in harmonious tints and shows a little girl and her fore-footed companion just having a little love passage all by themselves. The intelligent Gordon setter who is being fondled by the child looks, as he is, a "lucky dog," and surveys the world with a very contented air. The Ashton Valve Company are prepared to send a copy of this calendar to their friends and patrons, whose addresses they have, or to any engineer who is in charge of a steam plant, if he applies, stating the name of his concern.

Total Locomotives Built in the U. S.

From reliable information obtained from the various locomotive building establishments, we find that the total output in the United States for the year 1902 was 3,606 locomotive engines for use on steam railroads.

Every week brings us news of new companies being organized to build locomotives. If the prosperous times continue for two or three years longer companies will doubtless put up new works for the construction of locomotives; but in the meantime the greater portion of the new concerns of the character recently announced are similar to one in New England which is organized with $2,000,000 capital and nothing paid up.

The Pratt & Whitney Company, of Hartford, Conn., will give to those who apply an illustrated catalogue of their Thread Milling Machine. The tool is shown in half-tones and a line cut gives the name of each part. The letter press contains a description and directions for operating. The form of patented thread milling cutter is shown, and some samples of the work done are also given. The claim made for this machine is that it possesses practically all of the flexibility and adaptability to miscellaneous thread cutting that the engine lathe possesses; and that it does the work within narrower limits of error than any ordinary engine lathe can and at a fraction of the cost of engine lathe work.

The Buffalo Forge Company are keeping in touch with the festive season of Christmas and New Year's by issuing a mailing card, upon which is reproduced two old-fashioned prints, one representing a "Seventeenth Century Foundry in France," and "The Metallurgists of Antiquity." The reverse side of the card shows the various blowers which this company makes.

The certificate of the East St. Louis Locomotive and Machine Shops Company has been filed. The incorporators are M. M. Stevens, W. S. Forman and H. L. Browning. The present capital stock is $25,000, but that sum will soon be increased.

Nothing more conclusively shows the enormous amount of tonnage that is being handled by the railroads west of Pittsburg than the fact that the managers of the Pennsylvania lines west have decided to abandon the annual inspection of the roads and methods of operating officials. The reason ascribed for the unusual move on the part of the general managers is that the railroad men along the lines to be inspected have not the time to devote to the inspecting parties. In case they would take that time from business the operation of the freight would suffer immeasurably, much more in fact, than the condition, as it is now apparent, will permit.—*Ex.*

Owing to the high price of steel charged in this country by the Steel Trust, the Baldwin Locomotive Works have begun importing steel blooms from abroad. Last month a vessel arrived in Philadelphia which brought 500 tons of steel for the Baldwin people, and the firm expects to extend these importations right along. A ton of steel blooms costs about $13.00 to make, and the trust is selling it for $30.00, which can hardly be considered a moderate profit. In importing these blooms from abroad the Baldwin Locomotive Works have to pay $8.00 a ton duty, but yet they can do better than by buying steel in the United States.

We are informed that "One side of a piece of ordinary cotton duck with Protectus Insulating paint spread on fairly thick, was allowed to dry, thus making the duck quite stiff. The electrodes of a testing machine, which had a capacity of 10,000 volts, were placed one on each side of the painted cloth diametrically opposite and the current turned on. Readings were taken every time the voltage was increased, until the current jumped through, which was at 5,200 volts. The resistance of duck alone is so slight that it is impossible to measure it."

Steps having been taken to organize a Union of Austrian Locomotive Engineers, the Minister of the Interior forbade the formation of such a union on the ground that it would be a danger to the state. The organizers appealed to the Imperial Court, alleging that such a prohibition was a violation of their political rights. The court has decided that the prohibition by the ministry was legal and well founded.

The Southern Car and Foundry Company at Binghamton is making preparations to double its output of cars. There is every prospect that it will be able to put 20 cars per day on the market, instead of ten, as at present, within the next 60 days.

We understand that Mr. Frank Hedley, who has been for ten or twelve years general superintendent of the Lake Street Elevated Railroad, Chicago, has been selected as general manager of the Inter-Urban Railroad, New York, [illegible] embraces the new underground railway and other lines. Mr. Hedley learned the machinist trade in the Manhattan Elevated Railroad shops, New York, rose there to be a foreman, and went to the Lake Street Elevated as master mechanic. He is a grandnephew of William Hedley, who in 1813 built the first locomotive that did successful work in hauling trains. Its name was the "Puffing Billy," and it is now preserved in the South Kensington Museum, London.

The Court of Appeals decided recently that, if a man leaves his seat in a railroad car, even though he has placed therein a satchel, coat or umbrella, it may be lawfully occupied by another person. It came up on a case where a man had placed his belongings in a seat, left it, and when he returned, found the satchel in the aisle and another man occupying the seat. They had an altercation, the intruding party thrashed the other and threw his things out of the window. He was arrested, but won the case in the Court of Appeals. He deserved the licking and it is a pity that he won the case.

Some recent changes have been made by the Chicago Pneumatic Tool Co. in their representatives in this country. Mr. Geo. A. Barden, who has been representing the company at Buffalo, has been transferred to Philadelphia, and Mr. C. R. Green, who has been connected with the Cleveland office, has succeeded Mr. Barden in Buffalo. Mr. Chas. Parsons, who recently became connected with the company, is now traveling in the northwest. Mr. J. W. Duntley, president of the Chicago Pneumatic Tool Company, who has been spending some time in Europe, is returning with a large number of orders for their rapidly increasing trade.

The district office managers of the Westinghouse Electric & Mfg. Co., representing all the principal cities of the United States, spent a week in their usual annual visit to the works and offices of that company at East Pittsburg. A very enjoyable dinner, in honor of the visitors, was given at the Duquesne Club, at which the engineers and executive officers of the company were also present.

The men who learn endurance are they who call the whole world brother. —*Barnaby Rudge.*

The Small Shop Delusion.

BY EGBERT P. WATSON.

Richard and Robin were two pretty men who had worked all their lives in a railway shop—the same shop. Richard was past middle age, but Robin had not yet reached it; the former was a fair workman only, but a most unconscionably slow one. He was lively enough in his movements, brisk and active in getting about a job, but for some reason never was able to get it out of his hands; he would potter and potter until it made all the other men in his vicinity nervous to see him fiddling away at some part of it that he had already gone over before. Aside from this, he was a conscientious man and tried to do the best he could, but his best was not up to the mark. It was this last trait that kept him in the shop, for the officials have the measure of every man who works, but make allowances for congenital defects.

Robin was a very different sort of man. He was a better all-round hand, but even he left much to be desired as an expert workman. For one thing, his experience had been within a very limited circle, and he had a notion that the only methods he had seen were the best possible to get out work; neither was he what could be called a careful, close workman, being a little too prone to take a cut by his eye and measure for the fit afterwards—a proceeding that leads a man into pitfalls and snares very suddenly sometimes. He was of the "flip and flirty" type, snatching work out of the lathe before it had stopped running, throwing the back gears out and stopping it by a stick under the cone, jabbing the calipers into a chucked hole and starting the lathe up and a new cut, all at the same time—in short, doing circus feats all day long. He also whistled in season and out, a weakness which caused much remonstrance in the shape of blocks, dirty waste, and even oil cans, from those in the vicinity who did not care for mouth-organ music. For all this, Robin was not unpopular, and a short time before this narrative commences he had been made sub-foreman, at very good wages. Both of these men were on terms of intimacy, and as Robin was the more ambitious, he had got the idea that a small shop was, if not a short road to fortune, a pretty sure one in a reasonable time. They "cussed and discussed" this topic for a considerable time, and as I had had a much longer and wider experience than either of them, and was wholly disinterested, they took me into their confidence and asked me what I thought of the scheme—their giving up their present jobs and investing their small savings in a machine-shop outfit.

"The first thing I want to know is, where you are going to start your shop," I said.

"Right here, where we are known," was the answer.

"What! in this town? You must be

crazy, there are more shops here than there is work; what kind of a show do you stand to take it away from those who haven't enough now?" The reply was that they would do work cheaper and prompter than the other fellows, and, being "practical men," could see just what was needed to be done on any job at a glance, where the other fellows, being only "proprietors," couldn't tell what a job would cost or whether it was done right when it was done.

"Look here, Mr. Richard and Robin," I said, "you are fooling yourselves on the start. There is now in this town pretty nearly a shop for every factory, and they have been in operation for many years, with ample capital and tools for any kind of a job that comes along. You are going to put them out of business with a couple of 16-inch lathes, a drill press and a small shaper, a few files, three or four vises and an emery wheel. How long do you think it will take to run one of them out, so that you can get even his business, to say nothing about the rest of 'em?" All the reply to this was that I was trying to discourage them, etc., etc.; that they didn't expect to do a big business on the start, but were willing to go slow until they became known, and so on to the end of the chapter.

"Well, boys," I said, "that is all very vague and hopeless to me as regards the situation. What kind of work do you expect to get, or be able to do without a proper outfit? There is no paying work that can be had in this town anyway, with what you have; and how you are going to get as much money in hand every Saturday night as you get now, for months to come, is past my comprehension, or anything like as much. You don't know what it costs to run even a small shop like yours, for coal, oil, all sorts of sundries, broken tools, lost time, bad debts, rent, and so on. Three dollars a day won't cover it. Now, can you count upon turning out at least $8 a day to pay for the shop and your wages at $2.50 per day? I doubt it very much, for the first year at least. If you don't do $10 per day cash in hand weekly you won't make even the $8."

The reply was that they thought they could, and upon being asked what kind of work would return them that amount they said, with one accord, "job work."

"'Job work' is very elastic," I said; "what sort of job work?"

"Everything that offers—sharpening lawn-mowers, sewing-machine repairs, inventors' models, small break-downs of printing presses, and so on," they answered.

"Well," I said, "as a rule that sort of stuff is better out of shop than in it. If you know anything about that kind of business you should know that it is a dead loss from the start. You have to earn a dollar an hour, let us say, to pay your wages and the shop; that is $5 a day, or 50 cents an hour for both of you. It won't begin to pan out even if you had job work all day long and got the cash for it before the job left the shop. You have forgotten that there is such a thing as time, which goes on always without any let-up, and you will lose at least two hours every day by jobs not tailing on to each other. The job work is a delusion as a means of income. A woman asks you to come and see what is the matter with her sewing machine, and you spend half an hour washing up and going to and coming from her house. When you get there it takes you about half an hour, perhaps, to adjust the machine. If you charge her 50 cents she feels that she has been robbed—even if she pays it at all. A man comes in and wants a set-screw made that he can't buy in a hardware store. You pull down the lathe, make his set-screw and he says, 'How much?' It has spoiled the best part of an hour, and if you charge him 25 cents for the set-screw he gets crazy at once. Where is the money in this sort of thing? Nowhere. I have seen too much of it not to know just how it works," said I.

"Who does all the job work that is done," said the boys, "and why is it done if it doesn't pay, as you say?"

"The big shops do it, and small tinkers do it who work in their houses, and have no engines or tools to run and no shop expenses; but I never knew a tinker to make even a decent living. The big shops have to do it to oblige their customers, but no shop can live on it alone.

"Well," I continued, "you asked my views and I have given them, but I don't think you will profit by them, for, like lots of other machinists, you think that because you have worked in a shop you can carry on a shop, but one does not imply the other. Better stick to the day's wages you have than the bird-in-the-bush small shop."

Of course the reader has surmised, or surmises, that the boys despised instruction and started the shop, and the reader is right. They did start about a year ago, and the shop is still running; that is to say they both are still in it, but all the work they are doing is of little account. Not only this, but they found that the shop-gait they had always been used to, the jog-along, "any old time at all to get it out" sort of thing wouldn't do in their own work. But it is very hard to get over bad habits, and one of them (Richard) will never get over it. They did get some good customers, who had a regular line of work to give out which was profitable, and I saved them a severe loss on one job that came in, through their inability to calculate anywhere near the cost of it. They were going to bid $135 for a piece of work that would have cost $250 at the least, and this they acknowledged when I showed them their error; but, as I have said previously, they are just where they started as regards position, and do all the work themselves, except upon occasion when

they hire an extra man or so; and even the work they get has come chiefly from a personal friend, who assuredly will not be always to the fore. They lack what all men do who have spent their lives in a shop, and that is, business experience and business ways. For instance, a man wanted some considerable work done and asked them to come over and make an estimate of what it would cost. This stumped them at once; they hadn't the most remote idea of costs and how to get at them, but they went over and guessed at it, and didn't get within four miles of each other's estimate; one guessed one price and the other another, and both were out of the way by 50 per cent. They would have lost a pretty penny if they had undertaken the work; also, they lost about a day's work in the guesses, and one of them (Richard) was seriously of the opinion that a bill should be sent to the man for the time lost—*he made them lose it!* I got wind of a job that was to be done, and told them of it, adding that if they wanted it they would have to bid low, as there was another party—Mr. Low Bidder by trade—who was after it. They got the job, and I was curious to see how they would get out of it. A few days settled the question. They slid down hill rapidly; also, Richard's sand gave out, and he came to me and said they were going to lose on the job and asked me to go to the party and tell him so, and see if he wouldn't give them a little more! But this I heartlessly declined to do.

Now, this is a round, unvarnished tale of actual occurrences, suppressing only the names, which are neither Richard nor Robin, but it could be duplicated many times in other places.

Being "a practical man" is no sort of advantage in business unless it is supplemented by other very essential knowledge, but it leads a good many mechanics to think that it covers everything needful. In nine cases out of ten it is utter folly for men who have life jobs, as these men had, to leave them in the expectation of making something out of nothing. It is a saying that one cannot make bricks without straw, in which event it is the part of wisdom to continue making bricks for other people who have the straw. A small shop in a growing town, where there is plenty of work that pays to do, has a future before it, but it is not difficult to see the finish of a small shop in a town already full of shops where the only work to be done is of a desultory, unprofitable character.

We have received the picture of a steam engine made so small that a silver dime is used as a foundation plate; and the request is made that we illustrate it. The thing is a triumph of ingenuity carried out on a small scale; but we are not admirers of that species of industry. The maker's time might have been employed to a better purpose.

Electric Shock Accidents.

A useful insert in the *Electrical World and Engineer*, of September 6, appears as a detached sheet which can be framed or hung up in a conspicuous place. It relates to the proper procedure to be followed in dealing with the victim of an electric shock. The instructions are compiled by Dr. Augustin Goelet; and two cuts, showing proper position, are given. The means for resuscitation in electric shock accidents are the same as those for apparent death by drowning. That is a most important fact. Accidental shocks seldom result in absolute death unless the victim is left too long unaided, or efforts at resuscitation are stopped too early. It is well also to remember that the victim seldom receives the full force of the current in the circuit, but usually only a shunt current which may represent a very insignificant part of the whole. Well directed effort, persevered in faithfully, will in the great majority of cases restore those who have been "struck by lightning" in any form. As so many of our railroad companies have electric adjuncts to both shop and road, the diffusion of this kind of knowledge is most important.

Announcement was made from Philadelphia that the Pennsylvania Railroad has notified coal shippers that on and after the 1st of June $1 per day demurrage will be charged upon cars detained over an average of four days at Greenwich Point, Perth Amboy, Harsimus Cove and Baltimore. This action will interfere very seriously with speculators, who, taking advantage of the anthracite strike and the consequent increased demand for bituminous coal, are buying the latter and using the cars for storage purposes, pending a market for it at high prices. The reform is badly needed, and it is a great pity that it is not now in force, for it might help to accelerate the delivery of coal urgently needed. One of the most absurd moves ever made is that of an appeal by shippers to the courts to test the right of railroads to charge demurrage.

The *Glencot Mirror* says that when the Santa Fé Railroad was built from Pawnee to Ralston the people flocked to the little town of Skedee to see the first train go by. The engineer was getting close to the end of his run, and, thinking to have a little fun, climbed down from the cab and commenced oiling the engine. This aroused the curiosity of the people, and they crowded around the engine to see what he was doing. Having oiled up, he made two or three jumps for the cab, pulled the whistle cord, turned on the steam and opened the cylinder cocks and yelled: "Look out; I'm going to turn round." Immediately there was a scamper for the hills.

Railway and Locomotive Engineering

A Practical Journal of Railway Motive Power and Rolling Stock

Vol. XVI. | 174 Broadway, New York, February, 1903 | No. 2

A Tour in Scotland.

BY ANGUS SINCLAIR.

During most of my visits to Europe I have devoted the greater part of my time and attention to railway and engineering interests; but last summer I paid more attention to visiting places of scenic and historical interest, particularly to those of Scotland, my native country. I made a variety of short tours, and I venture to think that brief notes concerning them may interest the readers of RAILWAY AND LOCOMOTIVE ENGINEERING.

The start of one tour was from Perth, which was once the capital city of Scotland, has been the scene of more interesting events in Scot's history than any other city outside of Edinburgh; but it suffered so much from the ravages of war and of spoilers, lay and clerical, that few antequarian objects remain within its precincts. Its beautiful location on the noble river Tay and the wooded hills around it, could not be destroyed by wanton iconoclasts, and so the place still deserves its old loving name of Bonnie St. Johnstown To merely enumerate the historical events of which Perth was the scene, from 1200, when it became the seat of the Parliament, courts of justice and royal residence, until 1745, when the army of Prince Charlie, the last of the Stewart princes, took possession of the place, would in itself make a long story. Probably most of my American readers will associate the place most familiarly with Scott's "Fair Maid of Perth."

Pulling out from a remarkably handsome station, in a train of cars hauled by the ten-wheel engine shown, we follow the right bank of the Tay through a beautifully diversified country, enriched with all the scenic effects of wood, water and green pastures, backed by aspiring mountains. A few miles out from Perth we see at the base of a wooded hill the Palace of Scone which was long a royal residence. In an abbey connected with this palace there once was preserved with great care and pride what was known as the "Stone of Destiny." Upon it the Scots Kings were crowned until it was carried away to Westminster by Edward I, when that monarch had Scotland temporarily under his heel. The stone is now the base of the coronation chair used by the British monarchs. The value reposed in the stone came from an old Scots prophecy:

> Except old seers do feign
> And wizard wits be blind;
> The Scots in place must reign
> When they this stone shall find.

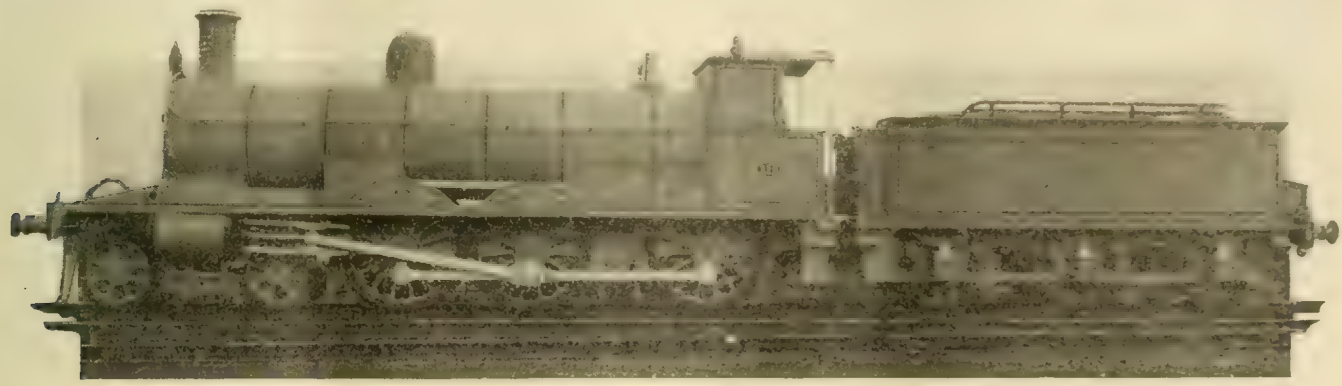
Superstition was a very living force in the days when this stone was stolen by the English monarch, and superstition has exerted an amazing influence ever since men looked with apprehension into the uncertain future.

A few miles further north on a "haugh" of the Tay we pass Luncarty, a place which years ago inspired awe in the hearts of history reading Scots. For centuries the coasts of all the British Isles were badly harassed by inroads of the sea robbers known as Norsemen. Scotland had suffered intensely, but in 970 a vast fleet of the robber Danes ascended the Tay and were annihilated by an army commanded by King Kenneth III. Up to a late date it was common for farmers plowing in Luncarty meadows to turn up spear heads and pieces of other warlike weapons. But modern historians throw doubt upon the whole story. When I read their expressions of unbelief I feel like Byron when he wrote:

> "I've stood upon Achille's tomb
> And heard Tay doubted:
> Time will doubt of Rome."

Following the valley of the Tay we soon reach the mountains with the towns of Dunkeld and Birnam as the first gateway, the carrier point between Lowlands and Highlands. Above Birnam is a high, isolated hill, from which a magnificent view is obtained, which seemed to embrace all Scotland, when I stood upon its summit, many years ago. That was the occasion of my first holiday tour. On a bright Sunday morning I was sitting, with two brothers, on the cairn at the summit of the mountain gazing over the vast expanse of mountain, field and forest, that a hazeless and cloudless sky held out in clear relief. We were joined by three gentlemen, one of whom knew every spot on the panorama. In telling about the places he told a humorous anecdote which I have recognized in various forms since that day.

That opening, he said, pointing to the west, is Glen Brand, through which Prince Charlie's army passed on its march that ended on Culloden Moor. Dissensions had broken out among the clans by this time, and so many of the Camerons fell out that the glen is still peopled mostly by



HIGHLAND RAILWAY PASSENGER ENGINE.

Camerons. It was there that an English tourist one day met a shepherd and asked him: "Are there any Christians in this district?" "No," replied the Highlander, "they are all Camerons."

Birnam Hill will be familiar to readers of Macbeth through the prophecy "When Birnam Wood shall come to Dunsinane." With the fulfilment of the prophecy the wood must have been carried away, for there is little covering now to the hill except heather. There are two magnificent trees near the foot of the hill, an oak and a sycamore, which are worthy to hold up their heads beside the giants of California. They are the last of Birnam Wood.

Dunkeld is a charming town and is said to have grown up by degrees around a church instituted about 570. A cathedral now in ruins is the principal attraction to visitors, but there are many beautiful places in the neighborhood. Nearly all the old religious houses in Scotland are in ruins, most of the destruction having been effected by the zealous rabble moved to frenzy by the soul-stirring denunciations of John Knox, whose jaw was much more powerful than his judgment, and ambition stronger than conscience.

In pursuing its northerly direction from Dunkeld the railway leads us for about twenty miles through the finest scenery I have ever looked upon. The line follows the natural pass through the mountains, which was the route followed by the Highlanders when they made expeditions into the Lowlands, to take possession of black cattle, corn or even wives that were needed for the sustenance, comfort and pleasure of the daring Celts.

There have been curious ways of courting among different people. When I was a boy I lived for two summers among the Grampian Hills, with an old lady highly versed in Highland lore, and she used to say that no marriages were so happy as those that followed when the man went to the Lowlands or to another clan and forcibly carried away the lass he wanted.

For years there was constant conflict between the Highlanders and Lowlanders, each following:

"The good rule, the simple plan
That he should take who had the power,
And he should keep who can."

The route is through a series of picturesque glens and passes which have witnessed many hard-fought conflicts in the days when the Lowlanders and Highlanders did not love one another. One of the most notable fights was the battle of Killiecrankie. That, however, came from a piece of political unpleasantness. When William of Orange and his friends made the British crown too hot for King James, and the last of the Stewart kings fled to France, a strong party adhered to his cause and fought for it. A leader among these was Viscount Dundee, the "Bonnie Dundee" of song. Dundee fled "to the hills and the woods and the rocks," as the song says, and gathered a following of Highlanders, who were generally spoiling for a fight.

He was leading his army toward Perth, when their progress was arrested at the narrow pass of Killiecrankie by the army of the king *de facto* under General Mackay. A short fierce conflict ensued and the king's troops badly beaten, but Bonnie Dundee" was among the slain.

The engine keeps toiling upwards, upwards with exhaust of work done seldom heard in the British Isles, and resembling more the long pulls on mountain grades so common in the United States. The line is single and is operated by the staff system very efficiently. Collisions are practically unknown, and the few that have happened were due to the kind of carelessness that no system can provide against. It is wonderful to see the expertness that firemen and signalmen acquire in exchanging the staff or the tickets at the intersection of blocks.

After a time we emerge from the wild wood, water, crag and towering mountain scenes, to follow courses through dreary glens with heather-covered hills on each side. The sheen of the purple heather is attractive these August days, and the yellow bracken (ferns) and green grass bordering the mountain torrents, make some diversity, but the treeless solitudes are not much more attractive than a journey through a prairie state.

I have used the word solitudes because that is the character of nearly all the Scots mountain regions. They are devoted to the raising of deer and game birds, the human animal being kept as far away as circumstances will permit. Yet a time was when these glens sustained a hardy population whose sons fought and won British battles the world over. But the time came when game paid better than the sheep and cattle raised by the natives, and so the people were driven to the colonies or into large cities. I cannot help feeling that Goldsmith's lines about an Irish village apply very well to the Highland glens:

"Ill fares the land, to hastening ills a prey,
When wealth accumulates and men decay.
Princes and lords may flourish or may fade,
A breath can wake them as a breath has made;
But a bold peasantry, their country's pride,
When once destroyed, can never be supplied."

Photo *Whyte, Inverness.*

SCENE ON HIGHLAND RAILWAY.

In due time we reached Inverness, a beautiful town, the capital of the Highlands. The place is well worthy of a visit even if a tourist had to go from Edinburgh or Glasgow for the purpose. It is on Loch Ness, at the east end of the Caledonian Canal, which, by aid of a series of locks, makes a passage between the Atlantic and the German oceans. I had a curious encounter here of the kind that seems to prove the world small after all. I went into a shop to buy some photographs and there found Mrs. George Maguire, whose husband at one time represented the Butler Draw-bar Attachment and other railway supplies. Mrs. Maguire was highly popular at the mechanical conventions during the lifetime of her husband, and will still be remembered by many of my readers.

From Inverness I made a visit to Culloden Moor, where the last of the Stewart princes fought the last fight to gain the British crown. It is a dreay spot, this "field of the dead," and was a fit ending for a hopeless cause.

There are many other interesting and attractive places about Inverness which will well repay the attention of people who enjoy seeing places which have been the theater of valiant human endeavor. After a few days spent in this neighborhood I resumed my journey northward. The railway by much twisting follows the Moray Firth past many thriving towns and villages that have the air of being finished and are cleaned up and decorated in nature's pleasantest garb, making comfortable homes for an industrious population. At the mouth of the Dornach Firth, an arm of the sea that stretches deep inward, we see Skibo Castle on the other side set like a diamond among the dark green woods. By the aid of a glass we can distinguish the Stars and Stripes waving from the highest pinnacle of the castle. There is no fear that Mrs. Carnegie's child will ever have to ask, what flag is that? as the children of an American lady of high degree living in Europe are said to have asked on seeing the American flag as they were entering New York harbor.

A visit to Skibo Castle impresses one with the noble simplicity of living followed by the family and the princely hospitality of the host and hostess toward numerous visitors. Mr. Carnegie is an ideal Highland laird and is carrying out magnificent improvements for the good of the district, and he is very popular among the natives who are not in the habit of receiving strangers with open arms. The only criticism I heard of him was from a free kirk Highlander, who said that Mr. Carnegie might spend his money to better purpose than putting whistling organs into their kirks.

Photo. STRATHPEFFER ON HIGHLAND RAILWAY *White, Inverness.*

Effect of the Coupler Law.

The New York *Commercial Advertiser* prints some statistics regarding the car-coupler law which shows that great improvement has taken place. It says: "In 1893, the year the car-coupler law was passed, the number of casualties caused by the coupling and uncoupling of cars by the old link-and-pin arrangement was 11,710, of which 433 were fatal. Last year, the first year in which the law was in full effect, the total number of casualties from this cause was 2,256, of which 133 were fatal."

It is evident that though the old link-and pin draw bar maimed a greater number, these figures show that it killed only 3.68 per cent. of its victims while the automatic coupler has been fatal in 5.9 per cent. of the fewer cases where injury occurred.

"On the Road to Mandelay."

If you want to read an account of an interesting engineering work in Upper Burma, get the Pennsylvania Steel Company, of Steelton, Pa., to send you a most artistic pamphlet called "From Steelton to Mandelay," which they have just issued, detailing the building of the famous Gökteit viaduct. This steel bridge is 2,260 feet long and 320 feet maximum height. It spans the gorge formed by the Chungzoune river, which disappears in a natural tunnel 500 feet below the viaduct foundations. This gorge lies 80 miles east of Mandelay, the capital of Burma, on the railroad to Kulon. The entire work was done by this enterprising company, and the material, which was made at Steelton, Pa., traveled 10,599 miles to the bridge site. The work was completed and the bridge opened by Sir Frederic Fryer, lieutenant governor of Burma in June, 1901. The pamphlet contains numerous beautifully executed illustrations and articles reprinted from the *World's Work* and the *Engineering Record*, of New York. The cover shows a sketch of the Steelton plant with tall black chimneys belching smoke, and a consolidation engine in the foreground, in strong contrast to the golden pagoda at Rangoon, where, as Kipling says: "We useter watch the steamers an' the hathis pilin' teak—on the road to Mandelay."

Mr. Andrew Carnegie on Libraries.

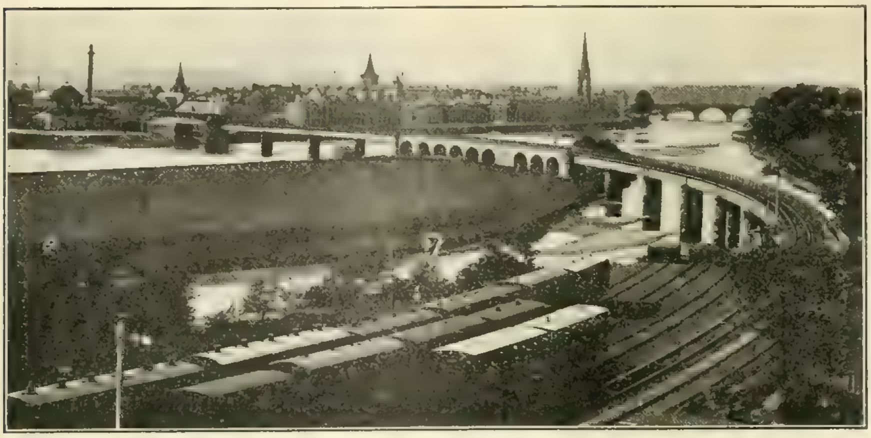
The Carnegie Public Library, the gift of Andrew Carnegie to the City of Washington, was dedicated on January 7. President Roosevelt delivered an address and Mr. Carnegie replied. In the course of the reply Mr. Carnegie said:

"I shall not descant upon the advantages of the free library, but this seems an opportune occasion to explain just what the free library business means upon which I have embarked. Seven hundred and thirty library buildings have been given, chiefly within the last two years, and most of them are built or under construction. During July last, 276 applications for library buildings were received from various parts of the English-speaking world, all of which were or are being dealt with. Upon arrival in New York last month we found over four hundred and fifty additional applications from the United States and Canada awaiting inquiry and decision, in regard to nearly all of which my secretaries are now in correspondence.

"From England, Ireland, Scotland, New Zealand, Tasmania, Australasia, Mexico and other parts, the cry is, 'Still they come,' for we have to-day 385 new applications on hand. Thus there are under way to-day more than 800 applications, the great majority of which will, no doubt, be given. Some will not be, for none are passed without careful investigation and unless we are satisfied that there is a community tributary to the library which is willing and anxious to support it as you were in Washington, thus making them in the fullest sense the libraries of the people, because maintained by the people.

"One reason for mentioning these figures is that it may relieve us of the charge of rudeness in not replying to the thousand and one suggestions which are made, urging entrance upon other fields of usefulness, while we are unable to keep pace with the demands of the work in hand.

"In my first public address made to our young men, in Pittsburg—how many years ago I need not mention—I told them to put all their eggs in one basket and then watch that basket. I have been a concentrator all my life. I have seldom or never known a great success made by the jack of all trades, the board member in twenty companies, the controller of none. I am in the library manufacturing business and beg to be allowed to concentrate my time upon it until it is filled. If ever it is filled I shall, of course, have to look out for other employment. That day, however, as you see, seems somewhat remote. As long as communities are willing as you are in Washington, to maintain a library from the proceeds of taxation, as part of the city's educational system, thus making it the library of the people and an adjunct of the public school system, so long I intend to labor in that vineyard, keeping myself free as possible from hearing of the woes and wants of humanity in general, to which, if I listened, I would soon become unfit for my special work, which I think best of all, for among all the suggestions made—and they are numberless—not one have I found which, to my mind, equals the free library maintained by the people as a field for the wise distribution of surplus wealth. I think it fruitful in the extreme, because the library gives nothing for nothing, because it helps only those that help themselves, because it does not sap the foundation of manly independence, because it does not pauperize, because it stretches a hand to the aspiring and places a ladder upon which they can only ascend by doing the climbing themselves. You cannot boost a man up a ladder. This is not charity, this is not philanthropy, it is the people themselves helping themselves by taxing themselves. They owe no man anything of moment."



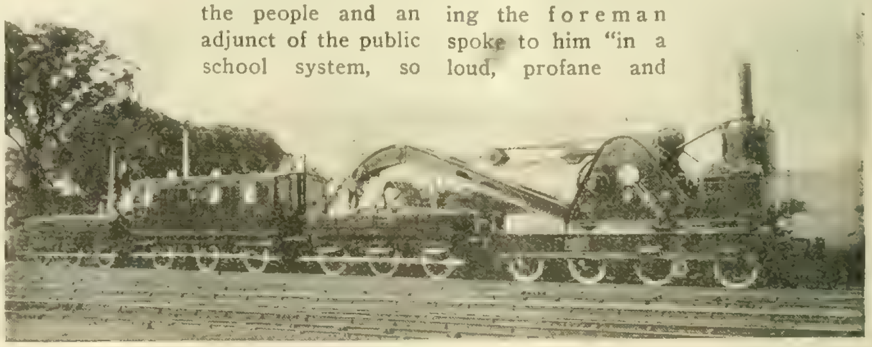
VIEW OF PERTH FROM BARNHILL.

Truth is Stranger Than Fiction.

A "tall talker" was retailing to an admiring audience the many wonderful things which he had done, or had seen done in the course of his non-railroad but most illustrious career. His statements were full of the "Yes-sir-I-saw-it-myself" style of doubtful verification, and he told of things which in sober truth didn't happen because they couldn't happen. A railroad man in the party stood it patiently as long as he could, and then quietly remarked, "In my profession I daily see far more really wonderful things accomplished which are the result of careful observation and hard thinking than anything which even the most gifted 'spellbinder' can imagine or narrate—a bluffer is simply wasting time on a mechanical engineer nowadays."

A Cranky Section Hand.

Patrick McCabe, lately a section hand on the 'Frisco road at Wichita, is suing that corporation for damages for injuries received while in its employ. His plea is that while working the foreman spoke to him "in a loud, profane and very boisterous manner, thereby causing this plaintiff to be nervous and excited, and thereby causing him to place himself in a position of great bodily danger, and to a greater degree than he otherwise would have done." The orders were given "in a very loud and boisterous manner, backed up by many oaths, such as 'Be smart,' 'Be quick,' and 'Move yourself,' etc.". Kansas section hands seem to be sensitive plants.



HIGHLAND RAILWAY WRECKING OUTFIT.

"A rolling stone gathers no moss," but velocity is sometimes worth more than verdure.—*Four-Track News.*

Newest Shops of the Canadian Pacific Railway.

The present shops of the Canadian Pacific Railway situated at the corner of Delorimer avenue and St. Catherine street, Montreal, are generally called, on the road, the "New Shops," though they have been in existence for more than eighteen years. At the present time plans have been prepared and some of the buildings have been erected for a thoroughly modern as well as an absolutely new plant.

The Canadian Pacific Railway people have purchased land in the eastern part of Montreal and are placing their now-correctly-styled "New Shops" at the head of Mireau street, on the line to Quebec, formerly the Q., M. O. & O. Ry. The grounds will occupy about 350 acres, being about 4,500 ft. long and 2,000 ft. wide, a plan of which was published in our December, 1902, issue. At present locomotive repairs and building is done at Delorimer avenue, and the car work at Hochelaga, a suburb of Montreal, and the object of the new shops is to concentrate in one plant of ample proportions and modern equipment and under one head, the work which is now done in overcrowded workshops and at separate points.

The total floor space of the buildings is about 75,000 sq. ft. which amounts to something over 17 acres. The buildings are to be of pressed brick, on rubble stone and concrete foundation. The roof trusses will be steel for the locomotive shop, the smithy and the foundry, while the car department buildings will have combination trusses, though the columns in all the buildings will be made of structural steel. The hot blast system of heating will be used throughout.

The capacity of the plant is to be 75 new engines per annum, in addition to the heavy repairs to 400 engines in the same time. The wheel foundry will have an output of 250 wheels per day. The passenger car shops will be able to turn out 100 new and 900 repaired cars per year, while the freight car shops are expected to turn out from 25 to 30 new cars per day while keeping up heavy repairs on 100 old cars a day. The power house details are at present under consideration, but electrical power will be used throughout with individual machine and group motors in the various shops.

The disposition of the shops on the ground is such that the almost indefinite extension of any one shop or department has been provided for without danger of interfering with or cramping any other.

The tracks leading to and beside the various shops all run parallel with the length of the grounds, and in the center, an outside overhead traveling crane crosses these tracks so that material can be unloaded where convenient, traversed across and delivered wherever required. The machine and erecting shops are under one roof with boiler shop slightly offset so as to provide for a separate through track and entrance at both ends for the boiler shop as well as the large opening into the machine shop. The erecting "pits" in the erecting shop are three long tracks, if one may say so, the center one being kept clear for the movement of material, and also for the entrance and exit of the locomotives. Engines which arrive on the center track are moved where required and are then lifted sideways by two cranes to either of the parallel tracks, made with pits, upon which the striping and erecting are done. It is claimed for this form of construction that engines can be very economically handled inasmuch as there is only the minimum lift required, every time an engine is moved. This not only reduces risk of accident by avoiding a high lift, but the power expended in the operation is probably the least required of any system where lifting is done. Entrance may be had at one end and departure at the other, so that the parallel track system does not cause any interference with incoming or outgoing engines. Boilers enter the shop at one end, while the products of the foundry and smithy enter it from the other end.

In connection with the passenger car shops is a 75-ft. transfer table which is located much nearer one shop than the other, thus giving very valuable space with parallel tracks in the rear of one of the buildings. The cars are moved upon this transfer table, as they are of course not lifted, and the arrangement of the tracks leading to and from the transfer table is such that it is possible to turn a coach, or for that matter an engine, end for end without the necessity of installing a turn-table. There is also a half-circle track in the yard which may be used for the same purpose.

It is understood that about $2,000,000 will be expended on this plant which will put the Canadian Pacific fully abreast of the times as far as up-to-date shop facilities and modern practice is concerned. The buildings at present erected, or in course of erection, are the boiler shop, the machine-erecting shop, the foundry and the smithy. Contracts for most of the others have been let and work upon them all will be steadily pushed to completion.

Photo. *Whyte, Inverness.*

URQUHART CASTLE, LOCH NESS, HIGHLAND RAILWAY.

Southern Pacific Pension System.

We consider that the pension system introduced by President Harriman for the employees of the Southern Pacific Company is more equitable toward the people to be benefited than the systems introduced upon other railroads.

In general the plans is similar to the system of the Pennsylvania, Illinois Central and the Chicago & Northwestern roads. Employees who have attained the age of 70 and who have been in the service 20 years or more are to receive pensions on the basis of 1 per cent. a year of the average salary received for 10 years previous to pensioning for each year of service.

Thus an employee whose pay has averaged $1.000 a year for 10 years prior to retirement and who had been in the service of the company for 30 years would receive a pension equal to 30 per cent. of $1,000 or $300 a year. Between the ages of 61 and 70 years employees incapacitated for further work may be retired by a pension board, provided they shall have been in the service 20 years or more.

The employees make no contributions to the fund, pensions being paid by the company in full and without any condition, the employees being at liberty to engage in other business after being pensioned, should they see fit.

Dating Ties with Nails.

The marking of ties has been suggested by the committee of the American Railway and Maintenance of Way Association, which had the matter in hand, for report at the third annual convention. The method of marking outlined was that each tie should have a special nail driven into it, at some specified distance from one rail or midway between the two. The nails should be made of steel, covered with zinc or tin, and having the year stamped in the head. Such nails could be had for about 6 cents a pound, each pound containing about 30 nails. When put in by the section gang the extra labor would be very light considering the accurate record which would thereby be secured.

It occurs to us that if this system of nail-dating was adopted, the month when any renewal was made could be recorded by fixing the position of the nail at a certain definite distance from a selected rail. For example, the nails driven in January might all be placed two inches from one designated rail flange. Those driven in February, four inches; those in March, six inches, and so on, increasing the distance by two inches as month succeeded month. The nails driven in December would be 24 inches from the rail flange, and as that distance is less than half way between the rails, no confusion would arise as to which rail was the rail selected to measure from.

Fluid Oil.

A few years ago fluid oils were considered to be best adapted for lubricating air brake cylinders, triple valves, etc.; later, greases were used quite largely for this purpose. Results obtained from the service of both these products, however, were not entirely satisfactory. Fluid oils were found to gravitate to the bottoms of the cylinders, leaving the tops dry or improperly lubricated, whereas the use of greases disclosed the fact that they gradually worked their way to the bottoms of the cylinders and were rolled up into balls. Realizing the necessity and value of a lubricant that would satisfactorily meet with the requirements of air-brake lubrication, the New York and New Jersey Lubricant Co., of 14 and 16 Church street, New York city, after much experimenting, succeeded in producing a non-fluid oil air-brake lubricant. Exhaustive tests made by many of the leading railways has demonstrated the fact that non-fluid oil does not gravitate to the bottoms of the cylinders, nor roll up into balls, but remains on the walls of the cylinders, thus keeping the leathers in excellent condition. We are informed that several of the leading air-brake superintendents and inspectors after making tests have decided that this lubricant is more generally satisfactory than the fluid oils and greases which were formerly used, and that it will greatly facilitate the efficient service of air-brake equipment. The N. Y. & N. J. Lubricant Co. will be pleased to submit testing samples free of charge, by prepaid express, to air-brake inspectors who desire to give their non-fluid oil air-brake lubricant a test.

The Baldwin Locomotive Works are so rushed with orders that they have declined to make contracts for locomotives except with the understanding that deliveries are not to be made within a year from date of contract. This condition of affairs has compelled some of the American railroads to follow the example of the Canadian Pacific and seek abroad for their new engines.

Photo. SCENE ON HIGHLAND RAILWAY. *Whyte, Inverness.*

Notes from Europe.

An entirely new type of tank engine has been built at the Great Eastern Railway shops at Stratford. It has ten coupled wheels, 4 ft. 6 in. in diameter, driven by three high pressure cylinders, 18 1-2x24 in. The boiler, which is 5 ft. 3 in. in diameter, has a firebox of large dimensions, similar to the Wooten type. A novel form of connecting rod for the inside cylinder is provided to clear the front axle. Two safety valves, working at 200 lbs. per square inch, are fitted, one column containing four "pop" valves, the other being of the ordinary Ramsbottom type. It is expected with this engine at starting to attain a speed of 30 miles per hour in 30 seconds, with heavy suburban trains of 15 carriages, seating 792 passengers, and often carrying nearly 1,200.

The Great Central have recently received from Messrs. Neilson & Co., Glasgow, some engines of two different types; one a six-coupled passenger, with leading bogie, and the other an eight-coupled for mineral traffic. In point of detail, both classes are to the present locomotive superintendent, Mr. J. G. Robinson's standard, and are painted black, with red lining. The principal dimensions are:

	Six coupled bogie passengers.	Eight coupled goods.
Cylinders	19x26 in.	19x26 in.
Coupled wheels	72 in.	55 in.
Boiler dia	56½ in., 4 ft. 8⅛ in.	57 in.
Total heat. surface	1,748 sq. ft.	1,765 sq. ft.
Weight of engine in working order	145,600 lbs.	137,200 lbs.

The London & Northwestern Railway have constructed at their Wolverton carriage shops an elaborate royal train for the use of King Edward VII and Queen Alexandra. It is composed of seven vehicles, the two private saloons running on six-wheeled trucks. The interior of the cars are beautifully furnished, and electricity has been introduced for many purposes, including the heating of the various apartments, waving fans for warm weather and cigar lighters for the King's smoking compartment. In the attendants' compartments at the end of the saloons electrical appliances for cooking are fitted. Altogether, the train is a perfect luxury, and nothing can approach it in this or any other country.

The Metropolitan Underground Railways of London, after experimenting for some considerable time with electric traction, are putting into service their first regular electric train on the new Ealing & Harrow section. New trains of seven vestibuled coaches are being constructed with three motors working on the "multiple unit" system. These trains have seating accommodation for 330 passengers. The cars have sliding doors at center and on the end platforms a conductor controls the lattice gates of the adjacent cars. To the list of the completed underground electric railways will shortly have to be added the Great Northern & City Railway, connecting the Great Northern Railway at Finsbury Park with the city. The trains, which are of an elaborate design, have been built for the contractors, Messrs. Pearson & Sons, from the designs of Sir Douglas Fox and partners. As in the Metropolitan Underground trains just referred to, these trains have a motor carriage at each end, and one in the center, the compartment containing the controlling gear being lined with sheet iron and asbestos for protection in case of fire. As it was intended in the original idea of this line to run the standard Great Northern suburban trains by a physical junction onto the new line, the tunnels have been constructed 16 ft. in diameter, as compared with the 12 ft. tube of the Central London. Now it has been decided to build the Finsbury Park station underground, although the public will benefit by the increased size and accommodation of the cars. The motor cars seat 71 and the trailers 73 passengers each, the total seating capacity of the train being 505, which is a record for this type of railway, the nearest approach being a Central London train accommodating 288 passengers. With a view of decreasing the vibration, the tunnel tubes are of novel formation, the upper half being of cast iron segments, while the lower are of brick.

CULLODEN MOOR, NEAR INVERNESS, WHERE THE ROYAL HOUSE OF STEWART MET ITS FINAL DEFEAT FIGHTING FOR A CROWN. STONES MARK GRAVES OF HIGHLANDERS.

Among British railways that are fitting locomotives with liquid fuel on the Holden system are the Furness & North Eastern. The former have recently applied it to a six-coupled side tank, with the ordinary arrangement, the oil being stored in the bunker. The latter company have had two of their large passenger engines running for some time on the Scotch expresses with great success, especially in the case of the six-coupled bogie engine of Mr. Wilson Worsdell's design, No. 2,006, exhibited at the Paris exhibition in 1900. In these engines, and also the 6 ft. 8 in. six-coupled successful coal-firing is very difficult, as the trains are heavy and booked on very fast time. A compact oil fuel supply

plant has been laid down at Gateshead shed, and several engines are to be fitted.

The experimental freight locomotive, which the Lancashire & Yorkshire Railway have had running for some time, fitted with the Vanderbilt cylindrical firebox, has, we understand, turned out very satisfactorily, and twenty more engines are in hand at the Harwich Works, and the adoption of this type of boiler and firebox will probably follow on other lines.

The officials of the English and French railway companies, running the cross channel services between Dover and Calais, have been investigating the possibility of adopting a ferry to replace the steamers, and have recently inspected those in use between the islands of the Danish Peninsula, where for a long long period they have worked satisfactorily. The Continental gauge is 1.5 meters, or approximately 4 ft. 9 in. between the rails, while the British standard is 4 ft. 8 1-2 in. There need be little difficulty from this fact, but as the maximum width of the Nord vestibuled cars running between Calais and Paris is 9 ft. 11 in., and the outside dimension of the South Eastern & Chatham stock on the English side is only 8 ft. 6 in., there is no possibility of running the French trains through to London, although the English cars would reach Paris all right.

Freight cars of large capacity are slowly making their appearance on the various lines, the latest being a 30-ton covered goods, wagon and box car for the Lancashire & Yorkshire Railway, built to the designs of Mr. H. A. Hay, the company's mechanical engineer.

After a period of 46 years' service with the London & North Western Railway, Mr. Webb, the eminent chief mechanical engineer, is retiring. The success of his compound locomotives is world-renowned, and his exhibit of the "Queen Empress" at the Chicago exhibition of 1893, will be remembered by many of our readers. The latest type of engine of Mr. Webb's design is the four-cylinder compound "King Edward VII" class, many of which have been built at Crewe, and are working the West Coast Scotch expresses and fast Manchester & Birmingham traffic very satisfactorily. In the electrical work of the company, Mr. Webb has shown great ingenuity, and among his many introductions the Webb-Thompson electrical staff apparatus for single line working is a well-known applance, adopted on all the single-track lines of the L. & N. W. R. and largely used in the U. S. A. Mr. Webb has brought the Crewe Works up to a very high standard of efficiency, and everything mechanical connected with the railway is made there, the space occupied by the various departments being now 116 acres.

The adoption of a standard vestibule connection for passenger cars is now engaging the attention of the chief officials of the British railways, and it is to be hoped they will be able to select a satisfactory one, which will be adopted by all, and not allow the present variety to be increased in numbers, and so repeat the errors of the brake question. The enormous expense of keeping up two brake systems, air and vacuum, becomes a serious matter now, when the operating expenses of the British railways absorb such a large percentage of the receipts. While mentioning brakes, the "either side" wagon hand brake controversy still rages, and practically nothing is settled, although many favor the idea that the companies are fencing the question, pending the adoption of some better coupler and continuous brakes on freight trains. To show the miscellaneous variety of connections between carriages in use in Europe, we annex some photos taken on various railways.

A de Glehn four-cylindered six-coupled express locomotive is being constructed at Belfast in France for one of the British trunk roads.

SKIBO CASTLE, SUMMER RESIDENCE OF THE WORLD'S GREATEST STEEL MAKER.

INVERNESS CASTLE.

Sir Hiram and Lady Maxim on one occasion were staying at a southern watering place. When the time came to pay the bill the landlord of the hotel looked askance at the proffered check. He knew the name, but had no evidence that the signer was the owner of it. Sir Hiram had not enough cash in his pocket to meet the case. Lady Maxim then invited the proprietor to go down to the pier, put a penny in a slot machine, and look. He saw a "moving picture" of Sir Hiram firing a Maxim gun in the presence of the Shah of Persia. That evidence was conclusive.—*N. Y. Commercial Advertiser.*

A word in earnest is as good as a speech.—*Bleak House.*

General Correspondence.

Overloading Engines.

Are the railway companies solving the problem of freight transportation successfully? Are they not sacrificing revenue in order to show up a big ton-mile haul? We know they are destroying the efficiency of their power by overloading and sending their engines to the repair shops long before they should be there, all on account of some official of high degree whose idea of economy got started on the wrong track.

The superintendent of motive power must slight his work because of the small amount allowed for repairs, and the condition of the engines is shown (on paper) as first-class when really far from it.

The enginemen are cut on valve oil so that the internal resistance of the machinery, which under favorable conditions is from 10 to 15 per cent., goes up to 25 or more. Not only does this mean a loss of horse power, but also a decided increase of coal consumption. An increase of oil means a decrease of coal consumption. The additional expense incurred for oil to secure the best results would be more than compensated for by the saving in coal. Suppose you give an engine one pint of valve oil valued at 7 cents to make a run of 125 miles, consuming 14 tons of coal at $1 per ton, and you then increase the oil allowance to one and a half pints, at a cost of 11 cents, and cut down your coal consumption to 13 tons (which is a fair inference based on personal experience), does this not show a net gain of 96 cents on the right side of the ledger?

Remember, when you cut the necessary supplies below what they should be, you encourage your employees to be dishonest.

Give an engine a fair rating, with an average speed of 20 miles per hour, and you will move more cars with her over her district in a week than you can, if you load her down, allowing no reserve power and cutting down the speed to 10 miles or less. While it is true that your ton mile per train will be less with the former, your revenue will be greater on account of the reduced time of freight in transit. For instance, if a car passes over a district in 10 hours, and returns to the starting point in another 10 hours, that car is earning just double as much as the car that consumes 20 hours going one way.

The argument may be made that by increasing the load per train, we have fewer trains on the line, and reduce the danger of accidents, which looks very well in print, but let us look at the matter from another point, and see if it is not true that we increase the danger instead of diminishing it. Is an engineer's brain as clear and safe when he is on the road 25 or 30 hours, as when he is out only 10 hours?

The passenger engineer working five or six hours has the right of track over the freight men, and the latter have to keep out of his way. The passenger man assumes no risk, the freight man all. The former has regular hours of rest after each trip, the latter none. The man with the longest working hours has the shortest rest.

The majority of railroad accidents are due to overworked brains, and, likewise, the overloaded engine is productive of the most failures. An engineer with an overworked brain is not only a dangerous risk to the public, but a financial loss to his employer.

The capacity of an engine for work depreciates according to the service she is put to, and the length of time she is kept in that service. Her rating ought, therefore, to be re-established from time to time.

Don't ask your enginemen to do the impossible with power that ought to be off the right of way. Have a pleasant word for them. Don't censure them for your mistakes.

Cut down your tonnage so that your enginemen can get over the road on schedule time. They would rather have rest than overtime. The results will show in increased revenue, and it is the large revenue a road earns and not big ton-miles that makes the stock "gilt-edged."

J. A. B.

Watch Inspection.

I am not a shouting Methodist, but I had to let go a big amen when reading in your December issue the little item about oppression in watch inspection service.

The writer has looked on aghast at the workings of these so-called watch inspections, having been in a position for many years to see and to know the true inwardness of many of them. The most general plan seems to be to "farm out" the watch inspection to the lowest bidder, the bidder doing the work without salary, or at least only enough to pay for postage stamps, depending for his profits on "what he can get out of it."

This scheme reminds one of the contracts to bury paupers, as let in most cities, where the price paid for each interment is not enough to pay for the lumber in a rough wooden box, yet these contracts are eagerly sought after, and in most cases pay big profits.

Many of these watch inspection rules are monuments of ingenuity, and look on their faces as honest as the proverbial mule, but when the poor train man is forced under the rules of the company to approach their business end and twist their tails, the result is the same in both cases, except the mule lands the blow on the stomach, while the philanthropic watch inspector, who is doing the work for "what he can get out of it," lands a blow on the pocket book.

The writer has tried a thousand times to picture to himself the expression that would come over the face of a general manager, should he be approached with the proposition to make the writer superintendent of motive power and machinery, without salary, but depending on "what he could make out of it" for remuneration. No doubt also that many of the large railroad supply houses would jump at the opportunity to furnish a purchasing agent, free of cost, to the railroad company, but where is the general manager who would even discuss such a proposition? Yet, they are not a whit more absurd than many watch inspection schemes, the only difference being that a different lot of men would have to "pay the freight."

There is no doubt that general managers are honest in the belief that they are doing the right thing; indeed many of the rules submitted for their approval would almost deceive the elect if they were not fortified with years of experience in the watch business, which few of them are.

As your item referred to in the beginning of this article says, no doubt if the matter could be brought to their notice, they would afford relief; in the meantime, one who sees the true inwardness of many of the schemes feels like looking up, and exclaiming, how long, oh Lord, how long?

A Quiet Observer

Defects of Sanders.

A number of air-operated sand devices have been gotten up, but they all have some defective parts as well as all other appliances, but I think they have never been shown up before. The first thing to look for is the leaks which may occur in pipe connection between the blower valve and the sand box. Second, if the valve is left wide open it reduces the pressure below that in the train line.

and applies the brakes. A strainer should be used in pipe connections to keep scale out of the nipple. A great many sand pipes become choked up by water which is carried from the main drum and dampens the inside of the sand pipe. Of course we understand that the roundhouse men are very particular about keeping stones out of the boxes.

The next consideration is the proper place where the sand should be made to strike the rail. Where the sand is blown exactly in angle between wheel and rail the wheel will reach the sand before it can blow off the rail. If blown directly down at right angles to the rail the air pressure will take the sand off the rail, and when blown against the wheel it will cause the sand to form a spray. A number of engines are run with one sand pipe stopped up, and there is then no sand on one side. Sand is useful on a slippery or greasy rail, and consequently the wheels on the side where the sand pipe is stopped up, will have no grip on the rail, and it is safe to say that a great many axles are sprung on this account. An engine slipping causes a shock to the fire and reduces the speed of the train so that altogether it means an extra scoop or two of coal. Another thing to consider is the number of wheels that may be sanded, and the shorter distance the train may be stopped in when sand is used. This latter will have to be considered later on. J. F. KURTH.

Fargo, N. D.

"Stop, Look and Listen!"

There are certain outward and visible characteristics about each of the great railway systems which interest both the locomotive engineer and the observing traveler in the coach or Pullman car. Warning signs at grade crossings afford an instance in point. These vary as much in what they say as in the material of which they are constructed and the forms in which they are erected. Not a few of them, if traced back to their beginnings, would develop interesting stories.

Perhaps the best known of these is the one which is seen along all the lines of the Reading system. It is the *multum in parvo* of them all, expressing in briefest and simplest, yet in the strongest terms, the duty of the pedestrian or driver of a road vehicle crossing at grade to "Stop, Look and Listen." An additional significance attaches from the fact that this sign has gradually found its way over the continent. Nor is its use confined any longer to the steam lines, the electric railways of central New York being the last to adopt it. Within the past month the Utica & Mohawk Valley (electric) Railway has erected it at a large number of crossings in fifteen cities and villages from Herkimer to Rome, including the New Hartford-Clinton branch.

Various accounts of the origin and adoption of this sign have been given, with no two seeming to agree. Interested to discover and record the actual facts in the case, the writer addressed an inquiry to Judge Campbell, general solicitor of the road, at the Reading Terminal, Philadelphia, who took the matter up in the writer's behalf and referred it to the two gentlemen acquainted with the subject and responsible in some way or other for it. These gentlemen were Colonel J. C. Fuller, vice-president and manager in charge of construction of the old Gettysburg & Harrisburg Railroad, now a part of one of the Reading branches, and Mr. J. A. Sweigard, then general manager of the Reading.

Colonel Fuller's reply to Judge Campbell is in part as follows: "In building the Gettysburg & Harrisburg Railroad we were obliged to cross many public roads, and were about to prepare a notice to put up at each crossing, when my attention was called to a court decision in a suit brought for injury at a crossing. The judge made use of this language, that it is the duty of every one to 'stop, look and listen before crossing a railroad.' I at once adopted the words, 'Stop, Look and Listen,' believing it a legal point in determining the responsibility of both the public and the railroad. I distinctly remember the trip of Mr. McLeod (president), and Mr. Sweigard (general manager), over the road, and our conversation regarding this sign. I have always felt that the use of the phrase originated with me, feeling considerable pride when Mr. McLeod and Mr. Sweigard adopted it for your (the Reading) lines."

Mr. J. A. Sweigard confirms the above to Judge Campbell as follows: "The circumstances were that Mr. McLeod and myself were on an inspection trip over the old H. & P. line and the Gettysburg & Harrisburg, from Carlisle to Gettysburg, and while on the latter road we noticed signs bearing this wording. I called Mr. McLeod's attention to the sign and recommended its adoption, in which he agreed and directed me to call his attention to the matter on our return to this city (Philadelphia), which I did, and the sign was made standard. The sign we saw there was a small affair, made of iron, and we, of course, improved on the size of letters and style, but the wording was used exactly as we found it."

A supplementary note by Mr. Wm. Hunter, chief engineer of the Reading lines at the present time, adds that the crossings sign was adopted by the company for use in the State of Pennsylvania on July 23, 1891. In his letter to the writer, Judge Campbell states the fact that it was found to be "especially adapted to circumstances covering the rule of the law governing travelers upon public highways when approaching a railroad crossing at grade." Ex-President A. A. McLeod died a short time ago in New York. ROBERT BRUCE.

Clinton, Oneida Co., N. Y.

Development of the Railroad Car.

BY EUGENE CHAMBERLIN.

The minimum cost per ton per mile at which freight can be carried, and methods to be adopted to attract and retain the patronage of the traveling public, are problems constantly confronting railroad companies, possibly to an emphasized degree to-day on account of keen competition.

Attempts to satisfactorily solve these problems have had all to do with improvements in the past and constantly going on in railroad equipment.

With possibly rare exceptions, the principal revenue of a railroad is derived from its freight traffic, and consequently the necessity of a freight vehicle which will most economically perform its functions is not only desirable, but absolutely essential if a satisfactory earning capacity is to be established and maintained.

By a reference to well-established data and the very able article of Mr. McMillan, in "One Hundred Years of American Commerce," we learn that the English stone car early in 1700, with flanged wheels and hand brakes, was really the inception or forerunner of the freight car, and in 1804 cars made in pairs, coupled together by iron draw bars, with joints at either end, cars having no sides, but in the middle of each car a fixed center pin upon which worked a bolster was the origin of the bogie truck cars having a capacity of ten tons, which capacity remained a standard for more than half a century.

The development of wheels as to section chill and flange was largely due to the efforts of Knight, Edgar, Winons and Davis early in 1800.

The American freight car of 1848 was practically the same box of to-day, having a capacity of ten tons. Roof covered with duck and painted and sanded. Draw bars of the link-and-pin type having springs operating in both directions. Coal cars of the four-wheel or "Jimmy" type, with a capacity of about six tons; draw bars of hook and link type.

In the early sixties the box freight car had a maximum length of 28 feet and capacity of 10 to 12 tons, and were equipped with hand brakes.

Some years later a disposition to increase the dimensions and consequent

capacity of freight cars was apparent with all roads, and after gradually going up the scale, resulted in a car of 34 feet length and capacity of thirty tons.

The Master Car Builders' Association organized in 1867 was an important factor in perfecting and causing roads to adopt certain suggestions in car construction and maintenance, the value of which soon became apparent, particularly in the interchange of equipment between the different roads.

Immediately following, came the air brake, applied by the Westinghouse Company, experimenting in 1868. Then the vertical plane coupler, supplanting the link and pin type. Just at this juncture, in the words of an illustrious statesman, railroads were confronted with "a condition, and not a theory." With all of the lighter equipment in service, having hand brakes and link-and-pin coupler, and a disposition on the part of some roads to continue the building of cars for local service having a capacity of 8 or 10 tons, and many of the four-wheel type, it was found that the advent of the heavier vehicle, equipped with couplers that were somewhat difficult to join with the link-and-pin type, and air brakes that would stop a car suddenly if applied in emergency—had a tendency while in train with the lighter vehicles, to strain the frames, break the draught gear and otherwise incapacitate the latter to an extent that only required a reasonable time to place the light equipment out of commission. Still the demand continued for cars of greater carrying capacity, and the limit having apparently been reached in timber construction, steel was substituted, the steel car possibly having its inception from the Fox pressed steel truck and others of that type now so generally used throughout this country.

The steel car of to-day, both box, coal and flat, or the steel under frame, with wooden box or house, is unquestionably the latest and most approved type of the modern freight car, having a capacity of from 80,000 to 100,000 pounds, with a satisfactory decrease in dead weight as compared with an all-wooden structure of same carrying capacity, were it possible to construct the latter of requisite strength.

The development of passenger equipment has been quite as much, if not more remarkable, and one had but to examine the Pennsylvania Railroad and other railroad exhibits at the Columbian exhibition, showing the Conestoga wagon, stage coach, locomotive and train of 1834, and Camden & Amboy train of 1849, to form some idea of the early progress in this line.

By reference again to Mr. McMillan's article, it is found that in 1814, on the Kenilworth Colliery Line, a coach was made by placing the body of a road coach upon a wooden frame fitted with flanged wheels. In 1825 the Stockton & Darlington Railway ran as an experiment a coach, and the first passenger car to run regularly for use of the public was placed on four wheels, the car having doors at each end and rows of seats on each side, and while the English were the first to invent both trucks and long passenger cars, with doors at ends, and were almost instantly discarded, it was left to us to make them the features of American car building.

The first passenger coach used in Pennsylvania in 1832 was a stage coach slightly enlarged.

The passenger coach of to-day evidently originated with three cars built by Winans in 1833. The passenger coach of the early 50s was of the plain box type, 30 to 45 feet in length, without clear story, having small windows and heated with stoves. Cars had little or no ventilation.

Improvements were constantly carried on, and with the advent of the clear story, or monitor roof, ventilation was secured. The Miller platform of 1867 removed the slack between cars.

Removal of stoves and heating by hot water, as utilized with the Baker heater, followed, which was in turn supplanted by steam from the engine, carried in continuous pipes and couplings under cars and thence inside to radiating pipes.

Hand brakes were supplanted by the Creamer brakes on some roads, and they in turn by the Westinghouse, first as straight air, and later by the automatic or three-way. The vertical plain coupler and continuous platform and vestibule replaced the Miller device. Cars were increased in length and a marked improvement made in seats, the reversible back type being almost invariably used—four-wheel trucks in many instances replaced by those having six wheels. Toilets and lavatories of improved types installed, ventilation given attention, and to-day the American passenger coach stands as a monument to the ability and genius of the American mechanic and places at the service of the public a vehicle which for comfort and convenience meets present needs.

The estate of Wm. C. Baker, inventor of the Baker Hot Water car heater, has issued a circular letter which quotes a judgment in the firm's favor, delivered by the United States Circuit Court for the northern district of Illinois. It relates to his filling funnel, which was so closely copied by a manufacturing concern as to constitute a case of infringement.

There must have been some few occurrences in the past year to which we can look back with a smile of cheerful recollection, if not with a feeling of heartfelt thankfulness.—*Charles Dickens.*

Old-Time Railroad Reminiscences—Lucky No. 13.

BY S. J. KIDDER.

That times have changed since I began my railroad career in the West will be apparent to those who chance to read these recollections of some of my earlier experiences in that then rapidly developing section of the country. At that period there were no examinations of engineers to determine their physical, mental, moral or mechanical qualifications, a good word from some brother engineer on the road or other recommendation interspersed with a few queries regarding the applicant's railroad experience being all that was required to ensure work at once, a regular engine as a general rule and a steady job. Fractions of a cent were not computed in figuring one's monthly stipend, as all engineers were paid by the day, work or play, with overtime on way freight or if more than a designated number of trips were made. Full pay was received by all regardless of the term of service and "rights" were an unknown quantity, the railroad officials determining who should have such an engine or run while competency or some special act of the individual which demonstrated his ability and interest in his employer's behalf often advanced him over others longer in the service.

Early in the spring of 1871 I left the Manchester Loco. Works with a new engine for the Burl. & Mo. River Railroad, of Iowa, now a part of the Chicago, Burlington & Quincy, to be delivered at Burlington, at that time the headquarters of the road. While en route I overtook an old friend, Charley Cole by name, also on a similar mission and we journeyed on in company until our destination was reached, about noon one pleasant March morning.

After dinner we called at the general master mechanic's office, but learning he was out of town and would not return until somewhat late in the afternoon, it was arranged that my friend Cole should see that gentleman and obtain receipts for the two engines, which arrangement would permit me to do the town. I to meet him at the shops later in the day.

I covered a goodly portion of the city, climbing first one bluff then another, many of the sidewalks being composed of almost endless flights of steps that compared, so far as exhausting the physical resources of the pedestrian, with Bunker Hill monument and at the designated hour kept my appointment.

As I approached the master mechanic's office I found standing in front of it the General M. M. and my friend Cole. The former was a man of stern mien considerably more than six feet in

height, broad in proportion, with some 300 pounds of avoirdupois concealed about his massive frame.

It was our intention to debark for the East that same evening, but what took place within the next few minutes changed, no doubt, the entire current of my life.

As I approached and was introduced, the first remark after passing the courtesies of the day the Gen. M. M. said to me, do you want a job? I replied I don't know, what kind of a job you got, he meantime sizing me up with critical eyes. It might be remarked here that I had been employed in my father's office for a considerable time, engaged mostly in reading newspapers, drawing pay, etc., was hardly more than a boy in years and with my bleached hands and face probably did not bear many of the external marks of an engineer. He questioned me as to my past experience, which, to tell the truth, had been somewhat limited, and my friend, an old engineer by the way and long-time acquaintance of the questioner, at an opportune moment spoke up, saying: Mr. Chalender, if you want a man, hire him, I will be responsible for his work. That he did want engineers was true, as shortly before my appearance he had asked Cole if he could send him some good engineers, and who in reply had said yes, but that he had a young fellow with him, though could not say whether he wanted a job or not. Well, the upshot of it was I replied that I would take a construction engine and be ready for work the following morning.

At that particular period of my life personal enjoyment, with a good home where board, washing and shoe bills did not come floating in with painful regularity, had a stronger attraction to me than hard work, but after concluding preliminaries I resolved to spend a few months in the West, then with a pocketful of lucre return home and resume the social side of life. Those few months, however, lengthened into years and seventeen of them passed before I left the service of this company.

The following morning at the appointed hour I reported for duty to the roundhouse foreman, Pat Riley, then seated myself on a bench waiting for something to turn up. Sometime after Foreman Riley directed that I take down the main rods of the Gen. McPherson and file the main pin brasses, then turned about and walked away.

As I had already learned such work was not an engineer's duty, and again, having no tools to work with, I simply retained my seat, feeling at the same time a sort of disgust and wonder at the proceeding. Perhaps an hour later he returned and inquired if I had done the work assigned me, to which I replied no, that I was not in the habit of doing such work without tools and did not wish to get into such habit.

He laughed, went to a cupboard, furnished me an outfit and when he again came round and inspected my work found I was far from a novice, for the brasses had been reduced in a way to close up on either side face to face in contrast to the method I had observed on several engines of having one side closed and the other gaping open.

At any rate he approved the job, then gave me instructions to go out on an extra with Jack Hawksworth, who at the time was breaking in new and rebuilt engines. At the hour designated we pulled out with the Gen. Grant, reaching Ottumwa in the evening without unusual incident. We made a return trip the next day and on the Saturday following, with the same engine, again went West. Reaching Batavia for a meeting point with passenger train No. 4, Jack announced his determination to go home, saying I could take the engine to Ottumwa where it would be turned over to the Middle Division, where it belonged.

This I did, and Sunday noon with the J. M. Forbes, No. 13, and Jack Woods, conductor. Jack is still agitating a ticket punch over the same right of way. I started on my maiden trip. We reached Burlington, but the 13 proved a terror. The engine had been used as an extra for some two years, run by first one engineer, whose engine happened to be in the back shop, then another, and when I got her she was in generally bad condition, rather from neglect than wear. She wouldn't steam, her pumps were erratic, the driving boxes and connections beat a tattoo, in short, she was emphatically a had-been, and by the time we reached Burlington the coal pile and my serenity were both well nigh exhausted. The delusion, however, that the engine was billed for the back shop was my only solace, and my surprise and disappointment may be imagined when the master mechanic informed me a day or two later that I would go to Thayer on the Middle Division and run a construction train. He concluded by saying he was aware of the condition of the 13, but for me to try and get along with her for two or three weeks, when he would furnish me another engine.

I was also instructed that Thayer, being but a few miles from the West Division shops, I should go there for any work the engine might require.

Running a construction train in those days was a most desirable job, as it assured full pay with very liberal overtime and no work Sundays or inclement days.

Thayer was a small way station of some thirty houses, contiguous to a large gravel pit, and by the time I had become fairly settled there I had concluded to overhaul the 13, and during the following three months every moment available was spent in work on that engine, no part being overlooked that could be removed without putting her on blocks. The tools to work with consisted of only those usually carried in an engine box reinforced with several files obtained from no matter where, and the point of a split switch rail was utilized for a vice. One after another the parts were taken down and repaired. The guides drawfiled and closed, faces of crossheads and wrist pins trued up, pump and check valves overhauled and ground in, eccentric straps and rod brasses closed, petticoat pipe revamped, in fact no part was neglected.

During the process of overhauling some blacksmith work was necessary and was done in an abandoned smithshop in town after patching and repairing the bellows. In brief, the repairs were finally completed, the engine was made a very good steamer, the pumps supplied plenty of water reliably, the "pounds" were either eliminated or largely connected, and my rattletrap had been converted into a very satisfactory engine, which from that time on easily held its own with other and nearly new ones also engaged in hauling gravel trains over the numerous and heavy grades abounding on this section of the line grades, too, that taxed the engines to their full capacity to handle their rates. Up to this time I had had occasion to visit West End shops but once. Desiring to visit Creston one Sunday, and there being no other way of getting there I took the 13 along, and as an excuse had the rod brasses filed; but as will appear later, my visit so far as the work done was concerned, did not meet with my approval, the job being hurriedly and badly done.

Not long after, one forenoon, the Gen. M. M. dropped off at Thayer and coming over to my engine began plying me with questions such as, how does she steam, how are her pumps, can you make the time, the construction trains by the way having long and fast runs, and numerous other questions to which I replied in the affirmative, and learning he was going to Creston I asked him to ride up with me that he might see for himself. He did so, the engine handling the train up the grades in fine style and quite contrary to what usually might have been expected at such time.

Upon reaching his destination he repaired to the shop office, and long after I heard what took place there. Said the G. M. M. to his subordinate, "what have you been doing to the 13?"

"Nothing."

"Haven't you done any work on the engine?"

"No; well yes, we did do a little work

on the engine some time ago. One day that chap brought his engine up here and reported the main rod brasses filed, but I guess the job wasn't done to his liking, for the last I heard of him was that he left town d——g the whole crowd and remarking that if that was the sort of work done in Creston he would do it himself hereafter, and I haven't seen him since.

Well, said the G. M. M., that young fellow who I first sized up for a schoolboy is all right, for the 13 is in much better condition than when he took her.

Some two months later I received a letter from Mr. Chalender to the effect that he would send me another engine, to which I replied that the 13 was all right and asked that I might keep her.

To this he answered that he had a back shop pit unoccupied, and as the time the 13 had been out of the shop antidated that of any other engine on the road he would have to take her in.

A few days later the 13 started for Burlington, and on that very day a head-end collision near Skunk river furnished more than enough material to cover the pit, and my rebuilt engine replaced one of those disabled, and it was not until the following spring, some 9 months later, that she passed through the portal of the shop for an overhauling.

Whether the G. M. M. ever knew of the work I did on the engine and the drawbacks encountered in accomplishing it I do not know, but when the cool fall weather concluded our construction work I was given a new freight engine and a year later was assigned to the best passenger run on the division.

Among the boys my somewhat rapid advancement was attributed to good luck, but as to myself I have always entertained the belief that to my work of overhauling the 13, lucky number you know, could be attributed the good fortune which befell me on the B. & M.

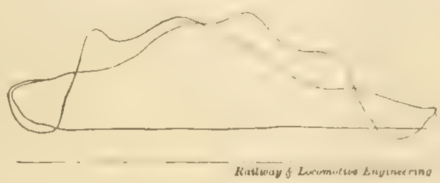
Curious Indicator Diagrams.

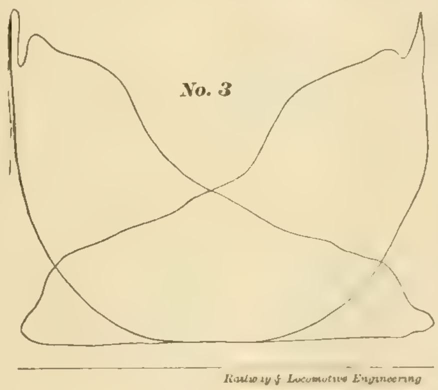
Dear Sir: Being a reader of Railway and Locomotive Engineering, I notice from time to time that you publish articles on steam engine indicator work. I saw in the December issue cards taken from a stationary engine, and being in that line of work myself a little, thought I would give a short one along the same line.

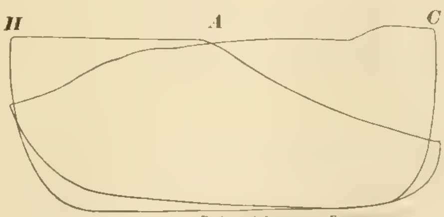
Card marked A was taken from a 20x42 in. Corliss engine. It can readily be seen that the engine is much overloaded, as an engine of this type should cut off at about 1-4 stroke. The difference in cut-off of the two ends of cylinders is due to the fact that the valve did not become disengaged from the hook on the end marked C at a late point of cut-off, while the one on other end did, showing a need of adjustment. It will be noticed that the release is late, an evil which cannot be overcome in a single eccentric engine that is overloaded because the eccentric must be set well back to give a late point of cut-off. The remedy is two eccentrics, one for admission and the

No. 1

No. 2







other for exhaust valves (or a larger engine).

Cards marked 1, 2 and 3 were taken by Mr. J. C. White about two years ago from a 6x7 in. automatic engine, running 320 revolutions. Any one familiar with the subject would not doubt something being radically wrong in the case of the first two. Upon examination, it was found that the engine had been reversed at one time by turning the governor wheel around on the crank shaft without changing the parts of governor. Upon this being done Card No. 3 was the result, with a much less steam consumption. The engine had been running in this condition for some time, several years perhaps, showing how a person can be deluded without sufficient knowledge, and also the sterling value of the steam engine indicator.

No. 1 was taken with no load, and Nos. 2 and 3 with a brake applied to wheel.

Decatur, Ill. W. R. Rusk

Imprisoned in Boiler.

Merle Enz, an employee of the C. H. & D., was imprisoned for several hours one night in the interior of the boiler of a locomotive which was being repaired at the company's shops at Findlay, Ohio. During the night he and another workman were engaged in repairing the interior of the boiler. They entered the boiler through the dome, which required quite an effort because of the small diameter of the aperture. When Enz made an effort to get out he found it impossible to squeeze through the dome. The more he tried the less progress he made, and finally he gave up the job and waited for more assistance. When several workmen arrived it required a great effort to pull the man out of the dome. In leaving the interior of the engine Enz was badly cut and bruised in the breast and back. His clothing was also nearly torn from his body.

We once knew of a steamer engaged in the Atlantic trade being delayed nearly a day by a workman getting stuck inside a boiler. The man was frightened nearly to death by the fear that they would fire up while he remained inside.

"A Royal Train."

The finest is none too good for the traveler and tourist of to-day, and in its Royal Blue Line between New York, Philadelphia, Baltimore and Washington, the New Jersey Central have a most complete and fast service. There are five trains each way each day, which make the run from New York to Washington in 5 hours. The coaches, parlor cars, buffets, observation, dining and café cars were specially built for these trains. The route of the Royal Blue is picturesque and the scenes presented are of great variety. The New Jersey Central operates a sleeping car service to Pittsburg, Cincinnati, St. Louis and Chicago. The stations in New York are at the foot of Liberty st., North River, and South Ferry. If you want to travel, and travel in style, use the Royal Blue Line. If you want a book on the Royal Blue, write to C. M. Burt, G. P. A., New Jersey Central, N. Y. It's free for the asking.

It is said that the Great Western Railway of England intends to try one of the celebrated four-cylinder compounds in use on the Northern Railway of France, with a view of obtaining reliable data as to performance, etc., under English conditions.

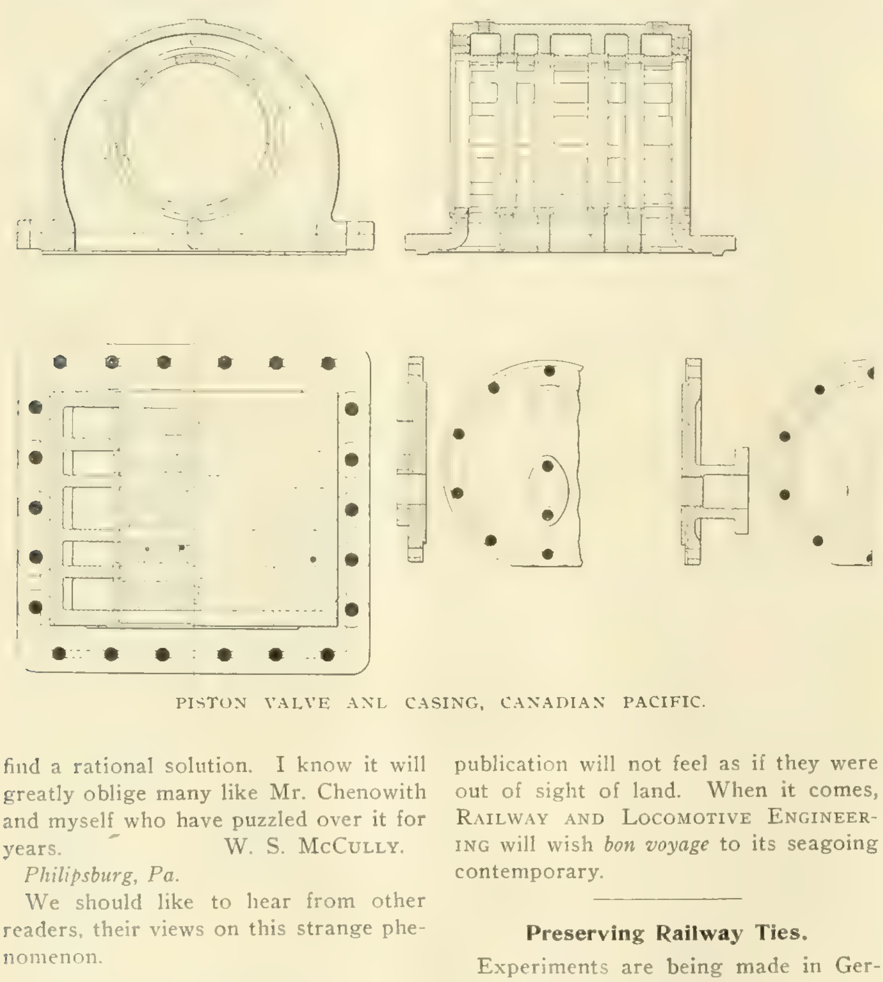
Why Are Parts of a Fire-box Cool When Other Parts Are Hot?

Referring to W. B. Chenowith's statement in the January number of Locomotive Engineering, relating to sheets in firebox of locomotive being cool when water is above the boiling point, I would say that I have been aware of this fact for twenty-five years, and have asked hundreds of men for an explanation of this phenomenon. But so far have received no satisfactory solution.

An easy way to demonstrate the truth of this statement—also to study the phenomenon—is to place an ordinary iron tea kettle on a bright fire, fill with water and let it boil briskly, then lift kettle off fire and place it on the palm of your hand. It will neither burn nor even feel hot. Kindly investigate this matter. Hoping you may be able to find a rational solution. I know it will greatly oblige many like Mr. Chenowith and myself who have puzzled over it for years. W. S. McCully.

Philipsburg, Pa.

We should like to hear from other readers, their views on this strange phenomenon.



PISTON VALVE ANL CASING, CANADIAN PACIFIC.

An Ocean Newspaper.

The London correspondent of the *New York Tribune* says: "The end of the present month will see a British mail steamer sailing from Liverpool equipped with a complete staff and plant for the publication on board of a newspaper every day during the voyage to New York. There is no doubt or un certainty about the prospect. The contracts have been made. Cuthbert Hall, managing director of Marconi's English company, yesterday told a representative of *The Daily Telegraph* that the arrangements had all been completed. The Marconi company will supply the news. The printers and machinery necessary to produce the first ocean newspaper are all ready to begin work. Cuthbert Hall hesitated to mention the name of the ship aboard which the first experiment is to be made, and only gave it in confidence until the result of the first voyage is known."

This will probably be a newspaper pure and simple in which politics will have no place, without literary supplements or financial statements or any of the magazine features which have been gradually incorporated into the make-up of the modern daily. Life on shipboard will always furnish plenty of humor and local color, and the readers of this new publication will not feel as if they were out of sight of land. When it comes, Railway and Locomotive Engineering will wish *bon voyage* to its seagoing contemporary.

Preserving Railway Ties.

Experiments are being made in Germany with beech as a material for railway ties. It has been found that without preservative treatment such ties are apt to rot internally, though they may be apparently sound on the exterior. On the Alsace-Lorraine lines favorable results have been obtained with creosoted beech ties, which have shown an average life of nineteen and a half years, while others preserved with zinc chloride have proved still more satisfactory, their life being twenty-one and a half years.

A Steam Railroad Chartered to Reduce Speed to Five Miles an Hour at Crossings.

One of the first railroads chartered in New York State was the Canajoharie & Catskill. From a business standpoint it was a case of starting from nowhere to reach nowhere, a project very common in pioneer railroad days. It was incorporated in 1830 and about 22 miles of it was built. That portion was operated for two seasons when a bridge went down and killed one man, which ruined the enterprise.

In the charter were some peculiar restrictions, says the *Merchants' Advocate*. They were not to exceed 20 miles an hour, and they were to slow down at crossings to five miles per hour and stop 15 minutes at all stations.

It was no easy matter at that time to get a railroad charter. In the Legislature some argued that the road would injure the Erie Canal; it would destroy the stage routes and ruin the sale of horses. One member said the infernal scheme would in the end depopulate the State of New York. Who would risk his life in a car going at the rate of 20 miles an hour, running on a narrow thread of a rail and a little cast iron wheel and an engine that is liable to blow up any hour of the day?

But the arguments in favor of the charter were also interesting. The road was tc be cut off and shorten the distance from Canajoharie to New York city, as travel and freight went mostly by the Erie Canal. The boats carried only 30 tons and made two miles an hour. The distance from Canajoharie to Albany is 69 miles by canal, and it took 38 hours to cover the distance.

One senator in arguing in favor of the railroad said: "We may not live to see it, but the day will come when people will ride over the iron rails at the rate of 25 miles an hour, and with comparative safety. Freight will be carried on these railroads and also the United States mails."

The Catskill Mountain Railway uses about four miles of the track of the ancient railroad and other portions of the road are visible, although covered with brush and trees.

Equipping with Piston Valves.

The Canadian Pacific Railway people are going in extensively for piston valves on their engines. As each locomotive passes through the repair shop at Montreal, she is equipped with an end-admission piston valve, and this is done without any alteration to the cylinders or the valve gear. The mode of procedure is simply to remove the ordinary steam chest, slide valve and yoke, and substitute a half-round cage, which is bolted down in place of the steam chest.

The old valve-seat is planed off so as to gain as much room as possible, and the cage makes a face joint with the new surface thus exposed. This cage is bored out, and heated when the valve bushing is pressed in, thus holding it tightly.

The piston valve used here has, of course, its valve-stem considerably off the center, as the height of the valve-stem above the old valve-seat is not altered, but the disposition of the metal surrounding the exhaust cavity in the valve and also the heavy valve-stem combine to bring the center of gravity of the whole valve considerably below its own center line. The liability to uneven wear of rings, due to any tendency of the valve to rock, is thus provided for. The valve-stem also passes through the front head of the valve-case in order to secure steadier motion.

The followers are held tightly in place by the valve-stem, with collar and nut, and by two studs in the upper half, tapped into the body of the valve. The bull rings are dowelled into and held by the followers, and the rings are compressed tightly when introduced into the bushing. An outline of the whole arrangement is here illustrated, and we understand a patent has been applied for.

The advantages sought are much more satisfactory balancing of the valve, and consequently less wear and tear on the valve gear all round. Greater port opening for same valve travel, and less repair work to be done, and greater facilities for doing what there is. The valve cage does not at any time require removal from the cylinders, unless in case of breakage. If at any time it is desired to re-equip any engine with slide valves, a false valve-seat can be put in, and the old steam chest bolted down again.

Owls and Superstition.

"The superstition about owls is a wonderful thing," said an old engineer, "and if I had not been inclined to be superstitious about the birds, the engine I was riding on one night would have been knocked into smithereens and the passengers in the coaches behind might have fared very badly. I am not always superstitious, but I am particularly so about owls. But I like the creatures, for one certainly saved my life. The incident occurred on a very dark night. The train was running at full speed. We were running on a straight line, and there was nothing for the fireman and myself to do but to look directly ahead and let her run. I had been looking intently for an hour, when something flew into the cab. It struck the coal pile and fell back dead. It was a great gray owl. With less time than it takes to tell it, I began to think that the owl was a bad omen, and I stopped the train immediately. I cannot say what made me feel so, but I was sure that death was ahead. I descended and walked to a switch that was a short distance in front of us. It was open, and a long train of empty freight cars was on it. I had the owl stuffed, and since that time he has had a place in the cab of my engine. I owe my life to the superstition about owls, and if another one strikes my engine I will close the throttle at once."—*New Orleans Times-Democrat.*

Thought a Fool Might Make a Fireman.

A well-known master mechanic had been for months pursued by Timothy Brady, a section boss, to employ his son Mike as a fireman.

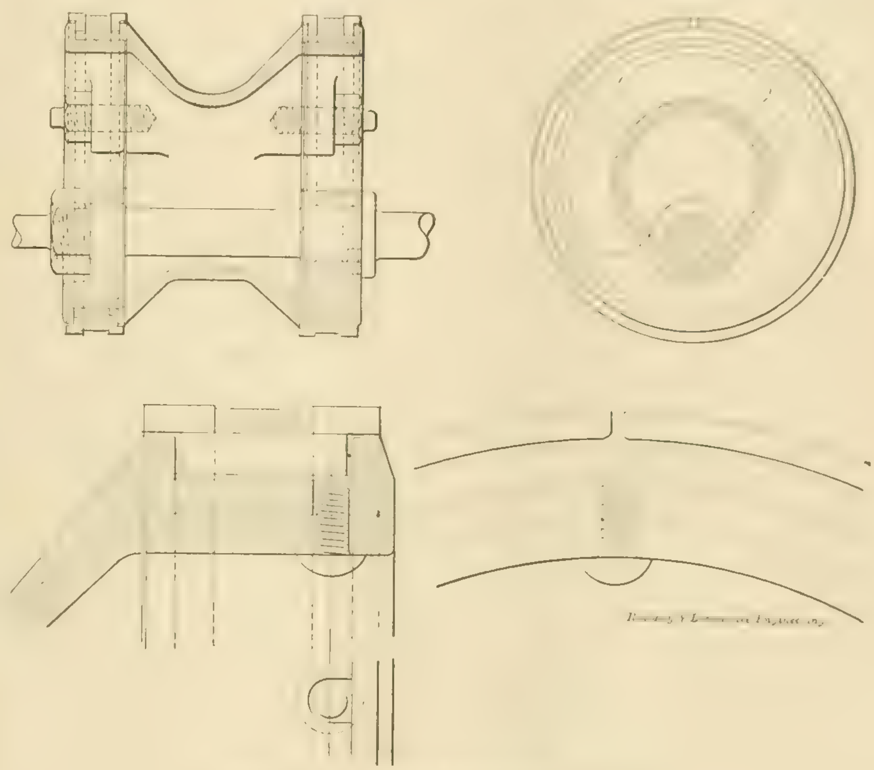
"Why don't you give your son a job on the section?" asked the M. M. one day.

"Well," replied Brady, "Mike is not very smart and is hardly fit to work on the section. In fact, if I say it, Mike is a born fool who reads books about locomotives, but he is good enough for a fireman."

Steam Turbine Boats.

Vessels equipped with steam turbines are coming steadily into favor. Two vessels having that kind of propulsion have been in use on the Clyde all last summer as excursion boats, and they worked so well that several others have been ordered by other parties.

A comparison of the fuel consumption of the turbine steamer King Edward and the paddle-wheeler Duchess of Hamilton, both of the same class, made by the same builders and plying on the Clyde, shows that the turbine boat does not suffer when one considers her higher speed. The figures for the season show that the King Edward burned 1,429 tons 16 cwt. of coal and covered a total mileage of 12,116, meaning 8.47 miles per ton of coal used, and an average speed of 18½ miles per hour. The Duchess of Hamilton consumed 1,758 tons 13 cwt. of coal, covered 15,604 miles, being 8.87 miles per ton, and an average speed of 16½ miles per hour.



DETAILS OF VALVE AND RINGS, C. P. R.

The Union Switch & Signal Company, of Swissvale, Pa., have just issued section No. 2 of their catalogue of interlocking and signalling devices. 1902. This section deals with mechanical ground connections and lead out appliances. The catalogue is well illustrated and contains tables of parts for ordering together with list price. Bulletin No. 9, issued by the same company, is concerned with the Kopp solid color glass. The red signal glass now put upon the market is a homogeneous mass commonly called "pot glass," and differs from the processes known as "plating" or "casing," in which a thin layer of red glass is spread on transparent glass. Other tints are made in the solid color glass also.

The chemical reaction which takes place when acetylene gas is generated, may be stated as follows: Calcium carbide (CaC_2) plus water (H_2O) produces acetylene (C_2H_2) and lime (CaO).

Railway and Locomotive Engineering

A Practical Journal of Railway Motive Power and Rolling Stock.

Published monthly by

ANGUS SINCLAIR CO.,

174 Broadway, New York.

Telephone, 984 Cortlandt.
Cable Address, "Loceng," N. Y.
Glasgow, "Locauto."

Business Department:
ANGUS SINCLAIR, President.
FRED M. NELLIS, Vice President.
JAMES R. PATERSON, Secretary.

Editorial Department:
ANGUS SINCLAIR, Editor.
F. M. NELLIS, GEO. S. HODGINS, JOS. A. BAKER, Associate Editors.

Advertising Department:
Eastern Representative, S. I. CARPENTER, 170 Summer St., Boston, Mass.
Western Representative—J. A. BAKER, 1204 Monadnock Block, Chicago, Ill.

British Representative:
THE LOCOMOTIVE PUBLISHING CO., Ltd. 102a Charing Cross Rd., W. C., London.

Glasgow Representative:
A. F. SINCLAIR, 7 Walmer Terrace, Ibrox, Glasgow.

SUBSCRIPTION PRICE.

$2.00 per year, $1.00 for six months, postage paid to the United States, Canada and Mexico. For other parts of the world, $2.50, or ten shillings. Single copies, 20 cents. Remit by Express Money Order, Draft, Post Office Order or Registered Letter.

Mailing address can be changed as often as necessary—always give old and new address, and if you subscribed in a club state who got it up.

Please give prompt notice when your paper fails to reach you properly.

Entered at Post Office, New York, as Second-class mail matter.

An Alleged Train Order in Slang and 28 Dead.

If the account given in the New York *Sun*, of January 2, concerning the cause of the Wanstead wreck on the Grand Trunk Railway is true, it furnishes an example of a certain kind of train dispatching, which should make the officials of that road hang their heads with shame.

The facts as given are, briefly, No. 5 express, going west, collided with an east-bound freight train near Wanstead, Ontario, and serious loss of life was the result. The cause of the accident was said to be a misunderstanding between train dispatcher and operator. There are three stations concerned in the affair—Wanstead, near which the accident happened, with Wyoming about five miles to the west, and Watford, situated about ten miles to the east.

It seems that before the express reached Watford, the dispatcher instructed the Watford operator to display his signal and hold No. 5 for orders. Immediately afterward the operator at Wyoming was told to hold the freight. That being done, an order was sent simultaneously to the express at Watford, and the freight at Wyoming to pass each other at Wanstead. A little later, the operator at Wyoming reported to the dispatcher that the freight was slow in getting away, and the Watford operator said the express was coming. Thinking that the freight, if permitted to go on, might delay the passenger train, the dispatcher avers that he said to the Watford operator, "May bust it," probably meaning that what he had heard about the freight being slow, might cause him later to cancel the crossing order. Almost at the same time Wyoming reported, "Freight pulling out." "All right, let her go," replied the dispatcher. The Watford operator says he only heard the words "bust it," and therefore destroyed the crossing order, and let No. 5 go on. On learning of the misunderstanding, the dispatcher did what little he could to stop the freight, but it was too late. The passenger engineer, we are told, believed he had a clear track to Wyoming, while the engineer of the freight held orders giving him a clear track to Wanstead. The single line between Wanstead and Wyoming was thus practically covered by a "lap" order.

From the *Sun's* account it looks as if the dispatcher had been trying to take the operator into his confidence regarding a possible change of programme, and as a result twenty-eight people were killed and about as many more were injured. We are not concerned as to whether dispatcher or operator be held to blame, the point which stands out prominently in the case is that any system of train dispatching is faulty in the extreme, where probable or possible moves on the chess-board are even hinted at over the wires, with the desperately dangerous possibilities of misconstruction. There is no more serious business on earth than the moving of freight trains against passenger trains on a single track road, and the only permissible orders in such cases should be clear and concise, and composed of a prearranged number of words, so that an operator can know certainly that he has it fully. All else is completely out of place.

There are on many railroads, rules and regulations and every conceivable form of mandate intended to hedge about engineers and firemen and the mechanical department in general, while the most extraordinary laxity may often be permitted in the dispatching office, because the man in charge is, by some absurd fiction, supposed to be the mouthpiece of the superintendent. The fact that a bit of slang language from the despatcher could be regarded by an operator as constituting a definite train order, or that such a frivolous and wholly ambiguous message could have been sent, concerning so serious a business as the moving of trains, places the method as outlined, by the *Sun*, in the most unenviable light in the eyes of the traveling public.

It ought not to require the uncalled for and violent death of 28 persons to key up a railroad department to such a measure of discipline as will enable it to even safely carry on the daily work in which officers and men alike are supposed to have had years of constant practice. Nor should such a spur to railroad officials be needed to cause them to devise some system by which a record of all that actually passes over the wire, might be had, and reviewed daily by a competent officer, whose business it would be to see that the despatcher's vocabulary was free from ambiguous words or inaccurate phrases, and that it should be clearly mandatory where train movement is concerned. The lesson of this disaster means that some check on the everyday work of the despatcher is urgently required.

The most trivial misunderstanding, which in mercantile life, might not involve more than the redirecting of a blotted envelope, when made over the live wire of a crowded railway system may have its terrible cost counted out to the full, in the irreparable loss of precious human lives.

Comparing Unlike Things.

There are strangely enough two recognized values for what we call one ton. There is the "long ton" of 2,240 lbs., principally used by our British cousins, and there is the 2,000-lb. ton used in this country and in Canada. The latter ton is the more convenient to use in calculations, and its twentieth part is exactly a hundredweight, neither more nor less, which is very satisfactory. There is, however, another value for the "ton," when applied to coal handling on a railway, in loading tenders. This value is not as definite as either of the others, in fact this so-called ton has no settled value at all.

It often happens that a railway company buys coal by weight and pays for so many tons, each composed of 2,000 lbs. The engines belonging to this same company are in all probability supplied with coal, not weighed at all, but shovelled into pockets which are filled up to a certain level, and these pockets are then said to contain 2, 3 or 5 tons as the case may be. As a matter of fact what the engine gets is not tons of coal, but a certain measure of volume, of which the exact weight is unknown.

There is generally a periodic attempt to make the coal bought by weight, tally with the coal measured out to the engines, because the latter are called "tons." As there is no definite ratio existing between the two, the work of making both sides of the coal account balance, may possibly be regarded as "fudging," by those who are disposed to look at the process with unfriendly eyes.

It may, however, be argued that definite volumes of coal, when dealt out to

engines, are near enough, as all fare alike. This would be so if some substance such as water was being supplied, for in the case of water there is practically a constant ratio existing between weight and volume all the time, which is not true of coal. Large lumpy coal and fine small coal when filled to the same level in a coal pocket, represent two very different amounts of fuel, and what the engine is concerned with, when making her record, is the amount of carbon carried on her tender, not the height it will pile up to, in a certain sort of receptacle.

If accounts are to be kept with accuracy the weighed ton cannot fairly be made to tally with the uncertain, measured, so-called ton. It is worse than using pounds, shillings and pence. There is a definite known relation between the three denominations of money, by which the value of any one can be accurately expressed in terms of any other. This connecting ratio does not exist between the weighed ton and the measured "ton."

If any one should say that six clocks equaled ten ink bottles, he would be asked by mathematicians to show the ratio connecting them, before he would be permitted to write the expression down in the form of an equation. If no definite ratio existed between them, he would never be able to establish their equality, and calling them all by one name would not alter the essential difference.

Run-of-mine coal differs sufficiently in heat producing qualities from carload to carload, as it is, without adding an artificial difference, in the way it is received and put upon the tenders. The desire at the present day for accurate detailed costs in railway operation is perfectly justifiable, and if this is to be rightly done, the accurate weighing of coal, supplied to engines, is as important as is the careful measuring out of oil. The accurate method is also fairer to the men who use the coal.

There are many locomotive coaling stations where the weighing hopper is not used, and where coal is supplied in bulk. At these places due allowance should be made for the fact, and the man in charge should not be compared with another man on whose division the most modern equipment has been installed, and in no case should coal records be "fudged" in order that a set of books may be made to look as if they balanced exactly.

A correspondent of ours recently pointed out that the monthly performance sheet was often made the basis for comparing unlike things. The real handicap of cramped quarters, unequal facilities or old fashioned methods is generally ignored when mere figures are set down. The same tale of bricks is too often expected from the man without straw, as that delivered by the man who has it, simply because a whole number and two decimal places on the sheet do not and cannot tell the whole story.

"Thou Shalt Not Keep Thy Neighbors' Cars."

Darwin once humorously connected the presence of a number of old maids in a village with the profuse growth of red clover in the vicinity. The chain of causation between these apparently unrelated facts was briefly that red clover is rich in honey, which attracted humble bees, and in extracting the honey, the bees helped in the fertilization of the plants. The old maids according to immemorial custom kept pet cats, and these cats exterminated field mice which preyed on the honey and the young of the bees. The cats incidentally helped the bees in the struggle for existence, with the result that red clover flourished where the gentle tabby was cared for.

Equally paradoxical as it may appear to the casual observer, there is a complete chain of causation between per diem and the prosperity of car builders at the present time. The substantially increasing business and bright prospects of the various car building concerns are strangely related to the adoption of a single rule in car service. One would naturally expect that the adoption of a regulation which practically increased the car equipment on most roads, certainly on all the large ones, would have left the car builders in very slack water. The reverse of this is, however, the case. The volume of business for which the builders of cars are now preparing is larger than ever, but the individual orders placed are small, and this fact furnishes the explanation of the apparent mystery, just as the cats did in Darwin's example.

The fact that the prompt return of cars to owners in all cases and from all places has left some roads short of cars, and these roads have been compelled to order new equipment for themselves. It was just as if a man had filled out his book shelves with the latest volumes from a lending library, and had preferred making a good showing before his friends, to observing the rules of the institution. When the day of reckoning at last came, and the lending library peremptorily demanded its own, the shelves of the apparently literary gentleman would become suddenly and woefully short of books, with the result that the local book seller would receive a small order, and the multiplication of such orders from others similarly situated would keep him busy.

The new car service commandment. "Thou shalt not idly keep thy neighbor's cars," strikes two evils squarely on the head. The habitual car borrower feels the blow, and the roads which relied upon filling out the tail end of their equipment with other people's cars, have been compelled to go into the market to make good the shortage. Per diem has beaten the bush all through, and the borrower has been compelled to break cover and make the best run he can for safety. The prosperity in the country which this reveals is, however, gratifying to all alike.

The storage-expecting consignee has felt the blow also, and he appears to have done most of the weeping and gnashing of teeth, wherever that greeting has been given to per diem. There is no more convenient store house in the world than a good, clean, rainproof box-car, sealed by a responsible railroad. When this most compact store house was available day after day, entirely free of charge, it was simply ideal. To ruthlessly take it away was hard indeed, but the cry of the consignee is really the howl of the free-lunch counter fiend when he is compelled to pay. It is too ludicrous to excite serious consideration.

The Other Ox Was Certainly Gored.

Among the many improvements which Per Diem has brought about may be mentioned a new and improved style of reasoning, something like that which Jim Skeevers called, "reasoning of the general managerial order." Not long ago an important official of the Rock Ballast & No Dust Railway, said to a brother officer of a distant line, "This per diem system is great. We have 20 per cent. more of our cars at home now than under the old plan. Those rascally roads which formerly turned a deaf ear to the most urgent appeals for the reutrn of our cars, are now simply turning handsprings in their efforts to get our cars home. But they do so from a sordid motive. They are forced by the contemptible fear of pecuniary loss, to return equipment which they would otherwise have selfishly kept idle, or at best dishonestly accounted for."

"Yes," said his friend, "I am delighted to hear that at last the miserable scoundrels have been made to squirm, but are you not also quickly returning foreign cars to owners?" "Of course we are," said he of the R. B. & N. D. Ry., "but my dear boy, it's different with us, we were always pretty good that way, and besides, as we have most of our cars at home, we don't require so many foreign ones, and moreover we have recently gone in for greatly enlarged terminal facilities, so that the release of cars is necessarily quicker, and latterally our operating department fellows have quickened the movement of trains, and then, a short time ago, we reorganized the method of making up trains and of sorting cars, so that although we had to spend some money we are right, up-to-date all

round and per diem can't lay a finger on us."

To all this his friend made answer, "Once upon a time, a loaded car which had traveled 800 miles all right on a trip, was found derailed at an open switch, and a gang of men were putting in a pair of wheels, while a bystander whose railroading had all been done almost exclusively in his mind, examined the car, and seeing that it had a badly bent axle, explained to the assistant bystander that the condition of the axle was the cause of the derailment." "Well, what's that got to do with per diem?" "Nothing, only the man looking at the car was confusing cause with effect—but I'm glad those other fellows are turning handsprings."

To Prevent Telescoping.

The Chicago *Chronicle* publishes a description of a recent invention of Mr. Geo. E. Dickson, of Chicago, which has for its object the prevention of "telescoping" in railway wrecks. The idea is to build passenger cars with ends having an angular or curved form, so that when the cars are on a straight track the ends will not be at right angles to the rails as they are now, but will stand at some angle, and these beveled car ends will act as deflectors in case of collision. It is expected that cars so made will, under the stress of a heavy collision, have each its front end thrown to one side and its rear to the other. Instead, therefore, of the telescoping action, it is intended that the cars will really lie together, *en echelon*, if we may borrow a military expression. To put it another way, if the cars were represented by a line of men in Indian file, all facing north before the accident, the position assumed after collision would be approximately represented by the line of men standing each three-quarters turn to the right. Details of the scheme provide for the protection of the sides of the cars from being crushed in, and also means to prevent the cars jumping up on one another.

We have no desire to disparage earnest effort to make railway travel more safe than it is now, the road in that direction is wide, but it is quite possible in avoiding the danger of direct telescoping by this form of construction, to court disaster in another form. The elimination of the car platform and the introduction of solid end cars, and continuous vestibules, with strong underframing to cars, is apparently the safe lines along which the evolution of car design by expert car builders on our leading roads, is moving. Mr. Dickson's plan means the dislocation of one or more "joints" of the train, and the possibility of pushing cars sideways down a steep embankment, or over a bridge, or against the jagged sides of a tunnel or rock cut, may be as serious a menace to safe railway operation as is the danger which he seeks to avoid.

The worst accidents in which telescoping has been the predominantly unfortunate feature, are frequently those in which old style cars, were concerned—cars with platforms carried on timbers bolted to, and projecting from, the car sills. In some cases there is reason to believe that the presence of the high speed brake on the ill-fated train would have averted dire disaster, or at least softened it into mere mishap.

The enormous amount of stored-up energy which must be dissipated before a moving train can be brought to rest was recently discussed at a meeting of the New England Railroad Club, in a paper read by Mr. Desoe. As an example he showed that a train weighing 1,500 tons moving at the rate of 25 miles an hour. would have 62,688,000 foot-pounds, or 31,344 foot-tons of energy to be destroyed, as far as the train is concerned, before it could be stopped. This amount of stored up energy, if suitably applied, would be capable of lifting the entire train more than 20 feet up in the air. Higher speeds with less weights may give practically the same results. These figures show the enormous forces which must be dealt with in solving the problem which Mr. Dickson has essayed. The deflecting method, in which the cars will not only be derailed, but probably shoved off their trucks, and bunched together, demands very cautious and conservative consideration from those best able to judge.

The Traveling Engineer.

We have before us the letter of a subscriber in which he makes some very pertinent remarks about the good that may be done by a thoroughly competent traveling engineer or road foreman of engines. He says that appointments to this office have too often been given to men who by training are not suitable for the position. A poor imitation of the resourceful, efficient traveling engineer, is a most expensive luxury. The only way is to have the real thing every time, and such a man earns his pay and makes money for the company. A traveling engineer who gets over the road in a Pullman car is as much out of place on a railway, as a representation of a knife and fork would be in a painting of one of Nero's banquets. Moreover, employing a traveling engineer to carry the latest unreliable gossip, or fake news of changes among officials, to the various round houses has been found to cost money without bringing an adequate return.

A man qualified to run an engine properly and economically and capable of imparting his knowledge to others is a very useful person as road foreman of engines. A good man has a large field to work in. He has the eternal coal consumption to look after; being constantly out on the road he is sure to personally see some of the breakdowns or engine failures which happen. He can do good work on the grade where doubling has become part of the programme and he can quietly assist many engineers and firemen in getting over the road. When he is the right kind of man he can often smooth over a good deal of friction between engineer and despatcher without bringing each case actually into court, and he is likely to be asked some questions which perhaps false pride would keep back from the Master Mechanic or the S. M. P. An efficient traveling engineer can well earn all he is paid, while the company can put something into the treasury as well.

President Loree Has Nothing Against Passenger Departments.

In the last issue of RAILWAY AND LOCOMOTIVE ENGINEERING we published some particulars of a story which has been going the rounds of the newspapers to the effect that President Loree, of the Baltimore and Ohio Railroad had been making some disparaging remarks about the passenger departments of railways.

A prominent general passenger agent, intimately acquainted with President Loree, wrote him on the subject, expressing his surprise at the sentiments attributed to him, which brought out the following reply from President Loree:

"I have your letter of December 11. The story has been told in so many forms that I have no doubt that you are familiar with it, but I perhaps remember best that version which relates that a lawyer once in excusing his client for not appearing in court in answer to a subpoena, alleged some 39 reasons, of which the last was that his client was dead. If I may say that the article referred to was a pure fabrication, and that I have never publicly expressed an opinion on the subject, perhaps the other 38 things I might say need not be said."

Against Nepotism.

An order has been issued by the Missouri Pacific management that no relative of an official shall be employed in a position subordinate to that official on the Missouri Pacific & Iron Mountain system and it went into operation January 1.

The order has resulted in a number of changes at every divisional point on the line in southeast Kansas, many men holding subordinate positions have been placed under superintendents to whom they are not related.

The motive of the order is to place all

employees on an equal basis in the matter of advancement.

It is an order that might very well be imitated by nearly every railroad company in the country. A burning grievance to thousands of efficient railway men is that by hard intelligent work they have acquired intimate acquaintance with railway details which ought to recommend them for promotion, but that they are kept back so that inefficient relations of officials might be advanced. The evil of nepotism is a growing one and is killing the *esprit de corps* of many railways.

The Dangerous Water Gauge Glass.

A dispatch from Buffalo reads:

Joseph Lacey, an engineer, while cleaning his engine on what is known as the ash track in the railroad yards of the Buffalo Furnace Company at an early hour this morning, was badly scalded about the hands by the breaking of a water glass. A hurried call was sent to the Emergency Hospital where his injuries were dressed. The cause of the accident is unknown.

Lacey was in the cab of his engine when the glass blew out. The interior was filled with steam and Lacey escaped by getting out of the window.

The British Parliament passed a law lately compelling railway companies to have protectors over the water glasses of their locomotives. Safety water gauges are sold by the Nathan Manufacturing Company, New York. The writer has one on his automobile and it is entirely safe from breakage.

A neat little Christmas card "wishing you a new year filled with much joy and gladness, peace and plenty," has been sent out by Mr. E. J. McMahon, of L. S. & M. S., to his many friends. The card shows the 20th Century Limited rounding a curve just as the shades of night are closing in. The mail pouch which is the emblem adopted by the Lake Shore & Michigan Southern Railway is also shown enveloped in holly leaves with bright red berries. It forms a most appropriate device for the season, as the Christmas letters and cards and packages and the unexpected check from your rich old uncle all come by mail, and the suggestion is pleasing. In acknowledging the greeting sent us, we wish Mr. McMahon and his road the best of good luck, all round the clock.

"As I understand it," said Mrs. Green, "messages by the wireless telegraph system go right through the air we breathe." "Yes, that is correct," assented Mr. Green. "Then," replied his spouse, "a person having handed in a message at the telegraph office may swallow his own words on his way home."

QUESTIONS ANSWERED.

(8) C. M. D. writes:

When an engine comes into the roundhouse, with fire out, to have boiler washed out, with 200 pounds pressure of steam, the hostler fills her up with water before he blows her off through the whistle. Why does he fill her up? A.—He fills the boiler for two reasons, first, because he wishes to somewhat reduce the pressure before blowing off, and, secondly, he does not wish to uncover the crown sheet until the plates are sufficiently cool to stand without injury to the temperature of the washout water. The blowing off of a boiler always brings down the water level, and for the following reason: Steam at 200 pounds pressure has a temperature of 381.6 degrees F., which is a long way above the temperature at which water boils in the open air. As the pressure sinks a portion of the stored heat is liberated and it turns more water into steam. At 150 pounds, the temperature is 358.2 degrees F., at 100 pounds the temperature is 327.6 degrees F., and all the time the pressure has been sinking, the heat required to maintain high pressures has been turning water to steam and blowing out, thus reducing the water level until the pressure sinks to zero, and the temperature to 212 degrees F. If plenty of water has been put in before blowing off, a good water level will be maintained and cool water may be introduced, as hot is allowed to escape through the blow-off cock, and the temperature of the plates may be reduced any required amount without undue strain.

(9) W. G. P. asks:

Why is the link saddle-stud usually placed to one side of the center line or link arc? A.—This question involves more than can be answered briefly. Suffice it to say that what is called the angularity of the connecting rod produces a not uniform travel of the piston. The angularity of the eccentric rods, and the fact that the pins connecting link and eccentric-rods are placed back of the link arc, cause errors in the valve motion, and the approximate readjustment of these disturbances is effected by offsetting the link saddle-stud. This causes a certain amount of slip in the link, which allows different points on the link to act on the link block. Although this causes variable valve travel, it practically counteracts the errors introduced, as explained above.

(10) M. R. D. asks:

If a boiler has 200 pounds pressure per square inch inside it, what is the total pressure tending to tear it apart? A.—This depends on the diameter of the boiler. For example, a boiler 64 in. in diameter under steam at 200 pounds, would have a pressure of 12,800 pounds acting on each semicircular hoop 1 in. wide. The way this result is arrived at may be explained as follows: Draw to scale a circle, the diameter of which is 64 in. Now suppose the upper semi-circle to be filled solidly with wood or some other substance. The pressure of steam in the lower half would act on the base of the wood, or on the diameter of the circle, and this pressure tends to lift the whole upper arch off bodily. This upward effort is resisted by the shell at either end of the diameter. Suppose this upper semi-circle or hoop to be just 1 in. wide and the internal pressure 200 pounds per sq. in. The total pressure on this hoop would be 12,800 pounds, as stated above. If the sheets were ½ in. thick there would then be exactly 1 sq. in. of steel sustaining a pressure of 12,800 pounds for every imaginary hoop or band in the barrel of the boiler 1 in. wide.

(11) P. R. J. asks:

Has a short valve travel any advantage over a long-travel, each with same cut off? A.—To get the same port opening, the lap on the short-travel valve must be less than that on the other. If the port opening for live steam is reduced on account of short travel, as it will be, the exhaust opening will also be restricted, therefore more inside clearance is necessary with valves of short travel. For fast engines a good fair length of travel is preferable to very short travel.

(12) S. H. G. asks:

What is the difference between temperature and heat? A.—This question can best be answered by telling you how each is measured. Temperature is measured by a thermometer and is spoken of as so many degrees. It is indicated by the expansion or contraction of some fluid, usually mercury or spirit. Temperature is really the measure of the rapidity of the vibration of the particles of any body. Heat is measured in what are called British thermal units. One B.T.U. is the quantity of heat required to raise one pound of pure water through one degree of temperature as measured on a Fahrenheit thermometer.

The mistakes frequently made by railway station telegraph operators makes us think that the youths who are appointed to these positions ought to pass periodical examinations similar to those required of enginemen and trainmen. Some railroad companies on employing a station operator merely find out that he can take or send messages. That is far from being sufficient. They ought all to be examined on train rules and on the movement of trains. A failure on the part of an operator to interpret an order properly often leads to disastrous results. The safety of the traveling public demands more efficient training.

One comfort, then, for ourselves, and another is to have done our duty.—*Christmas Stories.*

The Growth of the Locomotive.

BY ANGUS SINCLAIR.

(*Continued from page 5.*)

REQUIREMENTS OF A PROSPEROUS COUNTRY

Lord Bacon truly says there are three things which make a nation great and prosperous—a fertile soil, busy workshops and easy conveyance of men and commodities from place to place. The history of the world has proved Bacon's words to be true, but there have been nations blessed with a fertile country and busy workshops which have tried to get along without easy means of transportation, because of sectional differences concerning the defraying of the expense of constructing artificial arteries of intercommunication. The regions served by water transport were opposed to building roads for the convenience of localities remote from sea, lake or river, and thus conflicting interests retarded the progress of some countries for the time being and left great spaces of fertile regions undeveloped.

In the course of two-thirds of a century a vast wilderness on the American continent has been changed from gloomy, untrodded forests, dismal swamps and pathless prairies into the abode of a high civilization. Prosperous states, teeming with populous towns, fertile farms, blooming gardens and comfortable homes have arisen from regions where formerly savage men and wild animals were the sole tenants. A powerful factor in effecting this beneficent change has been the locomotive engine.

EARLY PRESSURE OF PRODUCTION UPON TRANSPORTATION—THE LOCOMOTIVE DUE.

Projects for providing facilities of transportation by rail originated almost simultaneously in the British Isles and the United States. Both countries were badly supplied with highways on which wheeled vehicles could convey heavy loads; both had tried canals and found them unsatisfactory in some respects. The increase of production of commodities growing faster than the means of moving them, led enterprising men in both countries to look in the same direction for relief.

The conditions of urgent necessity which led to the inventing of the steam engine were repeated as the volume of produce and merchandise to be carried went beyond the capacity of water carriage and inferior roads. The steam engine came when great properties were deteriorating because horse power was incompetent to concentrate great effort in limited space. It was a foregone conclusion that the steam engine would be applied to locomotive purposes as soon as the horse proved unequal to the work of supplying the motive power for roads and canals.

The application of steam to water transportation delayed for a time the advent of the locomotive, but thoughtful men had glimpses of what the steam engine might do in moving loads on land almost as early as attempts were made to use steam in propelling boats.

THE RAILROAD TRACK.

The railroad structure provided a way for the wheels of a vehicle to run upon a smooth, hard surface, where obstacles to progress, such as sinking of the wheels into soft places and mounting over stones or other projecting obstructions, would not be encountered. Such roads were to be found in various lo-

REMAINS OF RAILROAD TO QUINCY QUARRIES.

calities hundreds of years before the steam engine was invented. There are many traces of what were really stone railroads to be found in parts of Asia and Africa, where an advanced civilization flourished thousands of years ago. The rows of huge stone blocks, worn with myriads of wheels, are in many places the most substantial traces of an enterprising people long passed away. The writer has seen in the streets of Italian cities stone blocks laid down parallel, with a depression to keep the wheels of vehicles in place, and these make as smooth a roadbed as the inside surface of car-track rails provide for the truckman of our large cities.

NEED OF THE LOCOMOTIVE.

The nineteenth century had not advanced many years when people in the United States began to realize that something better than canals was necessary as a means of intercommunication if great parts of the nation's territory were to be opened up to settlement and civilization. There were numerous navigable rivers and long reaching lakes in this continent, but geographically they are far apart, and there is no means of reaching vast regions except by land transportation. To the ordinary thinker a system of substantial macadam roads would have solved the difficulty as far as draft animals could have aided, but these roads were not tried to any extent, for the cost of making them was beyond the means of a thinly populated country, for in many places stone was very costly and labor was exceedingly dear.

THE PINCH OF NECESSITY BROUGHT THE LOCOMOTIVE.

The pinch of necessity wonderfully quickens the inventive faculties. Long before a mile of tramway was built in the United States in connection with coal mines, engineers and far-seeing public men were discussing the possibilities of the steam engine as a means of accelerating land travel, and projects began to be agitated in different states to construct railways, or tramways, on which the steam engine could do the work of hauling the cars.

Those who looked favorably upon steam engines as motive power on railroads were a small minority, and they were considered by the majority as cranks and visionaries. Those regarded as sensible, progressive men, a little ahead of their time, favored horses for motive power.

The problem that public men were interested in was: How are we going to move our merchandise, and coal, and ore to the nearest point of water navigation? The transportation of passengers received little consideration from the early railroad schemers.

The need for the locomotive was much more urgent in the United States than it was in any other country. There were long stretches between western rivers and eastern estuaries that needed to be connected. There were no well-constructed roads of any consequence, and such roads, had they existed, could not have offered rapid transportation, so the railway was the chief hope of connecting the remote territory with markets and the seaboard.

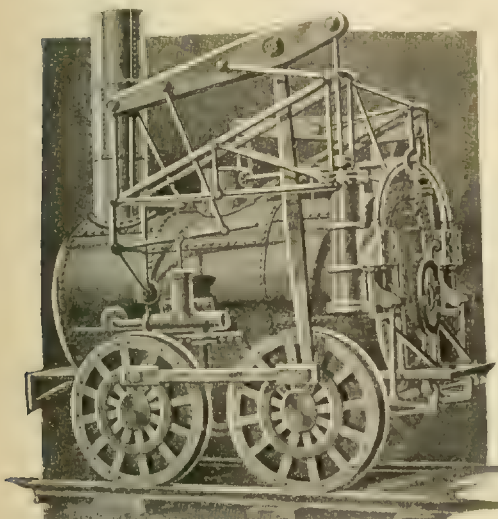
FIRST RAILROAD CHARTERED FOR GENERAL TRANSPORTATION.

The South Carolina Railroad Company was the first in the world to decide that its railroad should be operated by locomotives. Its construction was begun in 1827, but delays occurred which prevented it from being opened until part of the Baltimore and Ohio Railroad was in operation. Before the two railroads named had a working section finished there were several short railways in use, horses being the motive power. One was the Phillipsburg & Juniata Railroad in the Allegheny moun-

tains, and another was near Mauch Chunk, Pa., but the best known of the first experiments in railroad operating was at Quincy, Mass. This railroad was purposely built to convey granite to be used in building the Bunker Hill monument from the quarries to the Neponset river. In 1827 a piece of railroad was made by the Delaware & Hudson Canal Company for the purpose of conveying their coal from the mines to Honesdale, Pa., the junction with the canal.

THE "STOURBRIDGE LION."

The first locomotive on the American continent that was tried to run on rails



STOURBRIDGE LION.

was brought from England by the Delaware & Hudson Canal Company and was tried near Honesdale. The engine was selected by Horatio Allen, a celebrated pioneer engineer, and brought to the United States under his supervision. He acted as engineer in some trials made in August, 1829. The engine was of the vertical cylinder type favored by George Stephenson for hauling coal. The engine weighed 7 tons and was reported by Mr. Allen to be too heavy for the trestles. That report closed the usefulness of the "Stourbridge Lion," as the engine was called, and it was laid away and gradually dismantled. The boiler is now in the Field Museum, Chicago.

DISCOURAGEMENTS.

This failure did not dishearten the men who were advocating the construction of railroads. The first thirty years of the nineteenth century were for Americans a period of speculation about the probable success of railroad building and of the utility of the locomotive. But before the third decade was ended railroad construction was going on in various parts of the country. An impression is widespread that American railroad pioneers in building railroads and in designing the machinery to operate them were guided entirely by English types of machinery and by English methods of building the permanent structures which is a fallacy. Those who have studied most thoroughly the development of railroads and of railroad machinery believe that our railroads would not have been long delayed had Watt never worked on the steam engine and had George Stephenson never been born. Oliver Evans developed the high pressure as an improvement on Newcomer's atmospheric engine and Watt made radical improvements on the same engine by inventing a separate condenser. Evans' high pressure high speed engines were much better adapted for locomotive purposes than those of Watt, which were very ponderous affairs moved very slowly with very light steam pressure.

AMERICANS NEEDED NO PATTERN OF A LOCOMOTIVE.

Americans as a rule knew very little about what Englishmen had done in the same line when they began building railroads; they had very vague ideas about foreign locomotives and regarded the "Stourbridge Lion" as a freak. In consequence of this the first American-built locomotives were purely original. Seventy years ago there was scarcely any means of spreading information among communities only a few miles apart. The few newspapers published devoted their columns mostly to political news. To attempt spreading scientific information would have appeared ridiculous. Owing to this obstacle to the spreading of information, very few Englishmen were aware that peripatetic steam engines were hauling cars over permanent iron rails fifteen years before the Liverpool & Manchester Railway was opened. Six months before the opening of that railway the directors were inundated with wild schemes for supplying power to operate the road. There were plans proposed for hauling the cars by water power. Some proposed hydrogen, others carbonic acid gas. Atmospheric pressure had its advocates; others favored greased cog rails; but stationary engines with rope traction had most advocates. There was a multitude of counsellors who proved nothing except that even the scientific men of England had no knowledge of what had been done by Trevithick, by Hedley, Stephenson, Hackworth and others. No wonder that American railroad builders knew practically nothing about what had been done in their line abroad. The only things which our first railroad builders borrowed from England was the bar frame for locomotives and the track gauge of 4 ft. 8½ in. The latter might have been declined with much advantage.

AMERICANS WORKED ON ORIGINAL LINES.

I am not sure that the American railroad builders wasted any time trying to find out what others were doing. What they desired most was to be left to their own resources. The nation has always been celebrated for self reliance. To demonstrate that the faith in themselves was well founded, they proceeded to build railroads according to their own ideas, crossing the various bridges of difficulty as they were reached.

THE BALTIMORE & OHIO.

One of the most ambitious projects in railroad building first ready for operating was the Baltimore & Ohio Railroad, which was chartered in 1827 and partly opened in 1830. The objective point of that railroad was the Ohio river, a very comprehensive scheme, since merchandise or other products of the South would have the markets of a stupendous area of country. The route located involved the use of a great many curves and grades that were considered so formidable that few people believed the road could be operated by steam. But Peter Cooper, afterwards celebrated as a great philanthropist, was then a merchant in Baltimore, deeply interested in the prosperity of the city. He believed that the road could be successfully operated by steam and proceeded to prove it. Being a man with some mechanical ability, he designed and supervised the building of a small locomotive whose working presented the very best arguments in favor of a locomotive. Seventy years ago nearly all Americans were amateur mechanics, so it excited

COOPER'S TOM THUMB FIG. 8

no surprise that a merchant should design a locomotive.

COOPER'S ENGINE.

Cooper's engine was the "Tom Thumb," Fig. 8, a remarkably tiny locomotive with one upright cylinder 3¼ x 13½ inches, and an upright boiler having tubes made from gun barrels. Draft for the fire was maintained by a revolving fan. It performed the duties for which the engine was built, most of them having been of a missionary char-

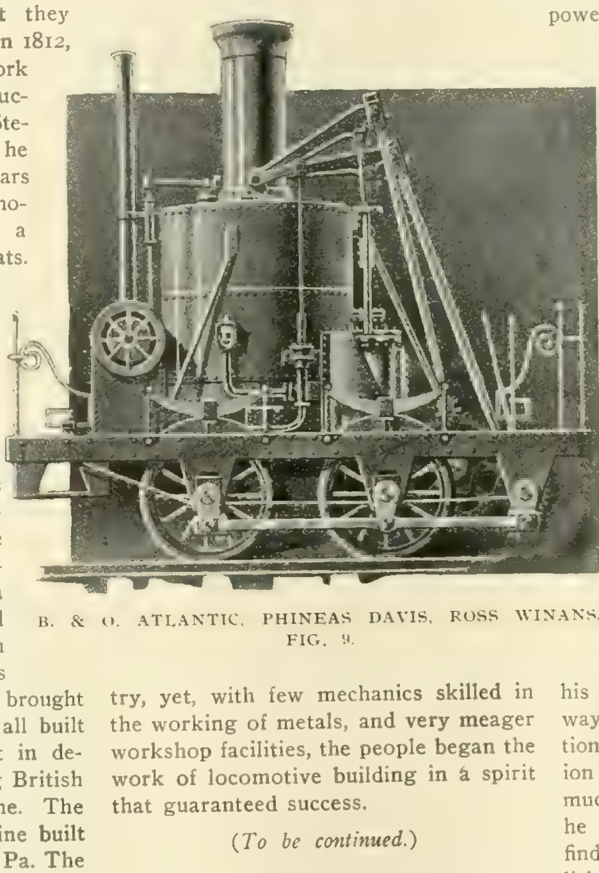
acter. It proved that steam power could be used to operate the Baltimore & Ohio Railroad, and revived the spirits of the promoters of the enterprise, who were becoming despondent about the prospects of the property. The "Tom Thumb" was little bigger than a modern hand car and was only about 1½ horse power, but its design seems to have exerted considerable influence on our early locomotives. Cooper claimed no originality in using tubes for the boiler, for Nathan Read, of New England, had built multitubular boilers years before.

The sentiment in favor of railroad building developed very rapidly in the United States after the shortcomings of canals had been plainly demonstrated. The men who took the lead in advocating railroads were the most influential and intelligent men in the country, having clear views about what they wanted. When DeWitt Clinton, in 1812, was urging through the New York legislature the act for the construction of the Erie Canal, Colonel Stevens, of Hoboken, insisted that he could build a railroad on which cars would be drawn by steam locomotives at a cheaper rate, and at a much higher speed than canal boats. He submitted particulars of his plans, and they did not differ much from the railroads that were subsequently built.

B. & O. DIRECTORS OFFER PRIZE FOR LOCOMOTIVE.

Shortly after the experiments with Peter Cooper's model locomotive, the management of the Baltimore & Ohio advertised, offering a premium of $500 for a locomotive, built in the United States, which would draw fifteen tons, gross weight, at fifteen miles an hour. In due time this offer brought to the company five locomotives, all built at different places, all different in design, and none of them imitating British models. One was a rotary engine. The preference was given to an engine built by Davis and Gartner, of York, Pa. The engine had a vertical boiler of a curious original pattern, and upright cylinders. She did not work very satisfactorily. The experience with this engine led to the building of the "Atlantic," Fig. 9, which was designed by Phineas Davis and Ross Winans, who was assistant engineer of machinery of the Baltimore & Ohio. The "Atlantic," which became known as the beginning of the "Grasshopper" type, has a vertical boiler with a fan for stimulating the fire. The cylinders were vertical, 10 x 12 inches, and they transmitted the power to a supplementary driving shaft by means of spur and pinion, which was geared up to make the wheels revolve twice for every turn of the crank. By this means wheels three feet in diameter were made equivalent to driving wheels six feet in diameter.

About twenty engines of the "Atlantic" type were built, and they worked very successfully in developing railroad traffic, and only went out of favor when engines with a longer wheel base became necessary. Some "Grasshoppers" were used about Mount Clare shops till about 1890. These engines filled a gap in railroad operating, but they exerted little influence on locomotive development more than warning designers against upright cylinders and upright boilers. They were, however, an excellent object lesson in difficulties that could be overcome by intelligence and perseverance. The United States was, in 1830, almost purely an agricultural country, yet, with few mechanics skilled in the working of metals, and very meager workshop facilities, the people began the work of locomotive building in a spirit that guaranteed success.



B. & O. ATLANTIC, PHINEAS DAVIS, ROSS WINANS. FIG. 9.

(To be continued.)

It is said that a Smooth-on gasket connection may take a little longer time to make than an ordinary steam packing one would, but when once made it will be more durable and seems to improve with age. Difficult flanged connections can easily be made with smooth-on as it is applied in a plastic state and adapts itself to the flanged faces, whether strictly parallel or not. For high temperature and high pressure work the following fact shows its value. It has been tested to 1,500 degrees Fahrenheit, and at the same time withstood 400 lbs. steam pressure without injury. Smooth-on, when hard, expands and contracts the same as iron, thus keeping the joint tight at all temperatures, and it will withstand the action of steam, water, fire or oil. The 60-page illustrated book, which the Smooth-on Manufacturing Company, of Jersey City, have got out, giving further information regarding this subject, will be sent free on application. The cements are packed in 5, 10 and 25-pound tins.

The Electric Contract Company, of 53 Maiden Lane, New York, has put upon the market a portable electric lamp, somewhat resembling a locomotive engineers' torch. In fact, the lamp can be used for the same purpose as an engine torch is used, and it has the advantage that it cannot be blown out. An ordinary torch will stand a good deal of wind, but often in its battle with the elements its light-giving power is greatly reduced. The electric torch will glow steadily while the pressure of the thumb is kept upon a button in the handle, or by the use of a small attachment the torch may be made to burn continuously. The company will be happy to send catalogue or any desired information to those sufficiently interested to apply.

Every inch of railway line in England may be said to have cost 12s., every mile £39,000, and it is interesting to remember that English railways are three times as costly as those of America.

Philip Burtt, general traffic manager of the North Eastern Railway, who spent several months in this country last year studying American railroad methods, speaking at the Railway Institute of New York, relative to his recent investigation of American railway methods, expressed general admiration of them, and said he was of the opinion that British railroad men can learn much from America. At the same time, he added, the best American roads will find much to learn and admire in English railroad management.

It is reported that the Schenectady Locomotive Works have supplied Japan with 155 locomotives during the last four years. There used to be a prejudice in Japan in favor of British engines, but now the trade with the United States has been worked up so well that all the supply of locomotives sent to Japan are made in America.

We are informed that the meeting of the board of directors of the Allis-Chalmers company was held on Thursday, January 15, 1903, and declared the regular quarterly dividend on the preferred stock.

Air-Brake Department.

CONDUCTED BY F. M. NELLIS.

Duplex Main-Reservoir Pressure Regulation.

A practice has been inaugurated on some of our railways, both in the East and the West, which has been found beneficial in long train service of the present day. This practice is made operative by the installation of a duplex governor instead of the single governor usually employed, so piped that the pump will operate against a comparatively low main-reservoir pressure when the brakes are released, and against the established maximum pressure only during the comparatively short time they are applied.

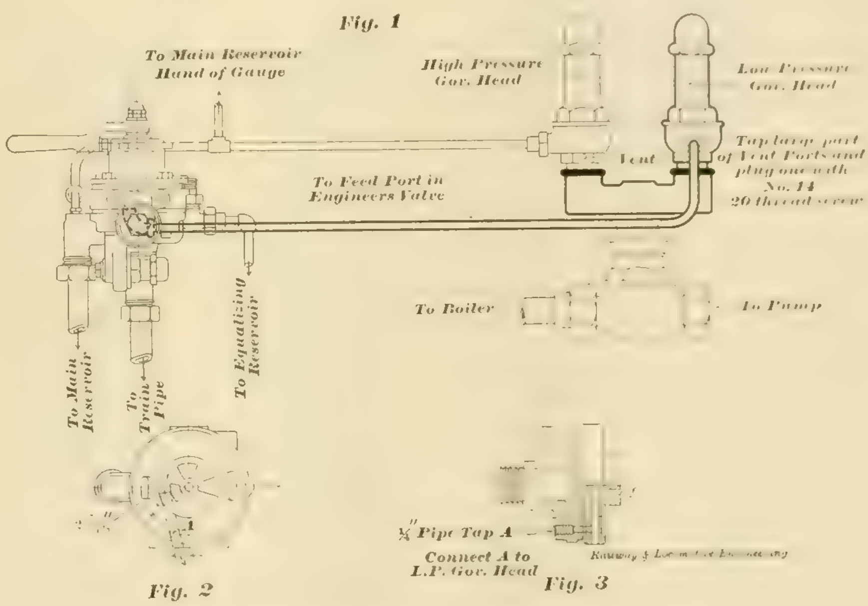
As will be noted by reference to the accompanying cuts, which clearly illustrate the method of piping the duplex governor to accomplish the purpose in view, the only parts required besides the standard apparatus are an additional top or regulating portion of the pump governor, the T-shaped piece, or Siamese fitting, for connecting up the two governor tops, and the necessary pipe and fittings, as shown by the heavy black lines in Fig. 1. As indicated, one governor head is connected directly to the main-reservoir pressure in the usual way; the other is connected with feed port *f* of the engineer's brake valve at a point between the rotary valve and the feed valve, which is marked *A* in the two small views at the lower portion of the illustration, Fig. 2 and Fig. 3. There are no fixed regulations for the low- and high-pressure heads, these being made to suit the local conditions. In general, for heavy service, they should be adjusted at 85 and 120 pounds, respectively, where the trainpipe pressure is regulated at 70 pounds. The 15 pounds excess pressure thus carried is ample to guard against any reduction in trainpipe pressure from the use of sanders or other "air brake parasites," where the amount of air so used is not more than the pump will ordinarily supply.

With the brake-valve handle in running position, main-reservoir pressure flows freely into the feed valve and, by means of the feed port, passes to the low-pressure head of the governor; the pump will then stop when the main-reservoir pressure has reached the limit at which the low-pressure head is adjusted. When the brake is applied, the position of the ports in the rotary valve is such that main-reservoir pressure cannot reach the feed port; a portion of the air in the pipe leading from port *A* to the low-pressure head then escapes through the vent port of the governor, allowing steam to pass to the pump, which operates until main-reservoir pressure, passing through the usual connection from the brake valve to the high-pressure governor head, is sufficient to overcome the tension at which it is set and close the steam valve in the usual manner.

It will thus be seen that when the brakes are released, which is the case during the larger part of the time, the pump operates against a comparatively low main-reservoir pressure; but as soon as the brakes are applied, it rapidly accumulates a high main-reservoir pressure with which to release the brakes and recharge the auxiliaries.

When the duplex governor is used, one of the vent ports should be plugged with a No. 14, 20-thread screw to prevent the escape of air through both vent ports when the governor is in operation, one vent port being entirely sufficient. All governors now shipped have provision made for the use of this screw, but in many cases it will be necessary to tap the large end of the vent port for the purpose indicated.

To facilitate the practice above described, all brake valves now sent from the manufacturer's works have hole *A*, drilled into the feed port, properly tapped and plugged; but in case it is desired to make this installation where brake valves have not been so drilled and tapped, the work can be properly done by following the plan and measurements indicated in Figs. 2 and 3, which show the proper location and size of hole *A*.



DUPLEX MAIN-RESERVOIR PRESSURE REGULATION

Slid Flat Wheels.

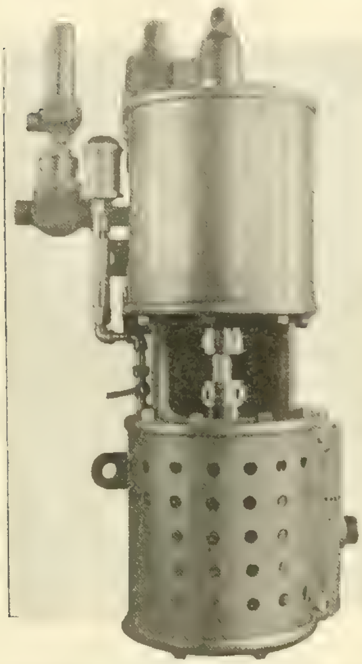
It is quite common with some railroads at the present time, when an epidemic of flat wheels strikes them, to pounce upon the air brake as a general breeder of trouble and the cause of the damage. So uncharitable to the air brake is this feeling of some railroad men when the season of flat wheels comes, that they look upon the air brake wholly as an intruder and mischief maker, forgetting meanwhile what the air brake does in better service and what it has accomplished in the way of higher speeds, greater carrying facilities, etc., during the past twenty years.

These are the persons who forget that flat wheels occurred long before the air brake was invented. Possibly that was before their time. If it was, and these persons would learn that part of braking history which tells of slid flat wheels caused by hand brakes on non-air-braked cars, they have but to observe trains where a number of air brakes are used on the forward end, and too generous assistance to these air brakes is given by the hand brakes on the rear cars, immediately back of the air-braked cars.

Perhaps a more forcible object lesson in this line would be to observe the flat wheels which too often occur on the caboose car itself. This is especially true where but two brakemen are assigned to a train and the rear brakeman, or flagman, is obliged to assist in holding the

train, which he generally does, if at all possible, with the caboose brake itself.

One of the greatest recommendations of the air brake on freight trains is that it brakes practically uniformly on all cars; hence the less likelihood of slid flat wheels. In the olden days, before air



AUTOMATIC SIGHT FEED LUBRICATOR FOR AIR CYLINDER

brakes were invented, or in operation on freight trains, it was the practice of the brakeman to select two or three cars in his portion of the train where the hand brakes were in good order. With these selected brakes, and the assistance of his "club," he would do his portion of the braking on the entire train. Thus half a dozen cars were often obliged on a trip to do the whole braking of an entire train of 25 to 40 cars. The result of this to an observer at the foot of a heavy grade, or at the end of any heavy application, was the pounding of a new "slid flat" which could be plainly heard.

Indeed, on mountain grades where this practice was carried on, wheels were frequently known to crack after cooling off at the botom of the grade, due to the heating of the continued and heavy application of the brakes by the brakeman with his "club."

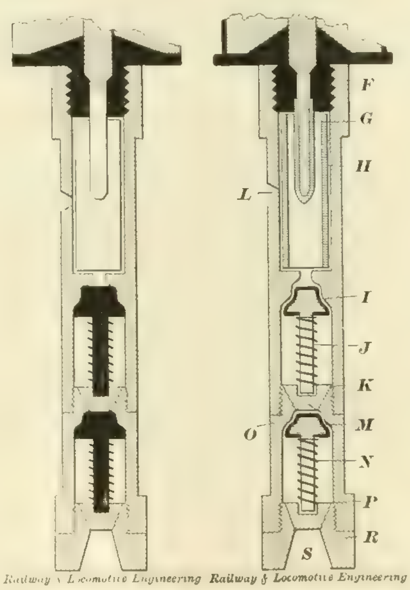
But in those days freight trains were neither so numerous nor so long as they are at the present time, and the number of slid flat wheels were therefore below the number of to-day; but taking into consideration the greater number of cars run at the present time, it is fair and reasonable to say that there are far fewer slid flat wheels per air-braked car today than there was in the past with the hand brake.

Even to-day we find non-air-braked cars with slid flat wheels. This goes to show that the brakeman is still inclined to select a good brake and stay by it to the foot of the grade or the end of the stop. Of course, there are, sometimes, slid flat wheels on air-braked cars; but it is only just to the air brake to say that the majority of these slid flat wheels were not produced by the air brake which brakes uniformly and to a limit, but rather to the setting up of the hand brake in yards and the pulling of the car by the switch engine while the hand brake remains set; or, possibly, it may have been "clubbed" at some time.

These points should be remembered by those unthinking persons who feel disposed to unqualifiedly condemn the air brake at those seasons of the year when the slid flat wheels almost invariably set in to the great annoyance and expense of railroad companies.

Air Brake Charts.

We are pleased to be able to tell our many readers that during the present year a valuable educational adjunct to Railway and Locomotive Engineering will appear in several numbers in



AUTOMATIC SIGHT FEED LUBRICATOR.

the form of air brake charts, in which a unique color scheme will be used. The charts will consist of graphic color comparisons, representing the variations of pressure during brake operation of the quick-action brake, the high-speed brake, the high-pressure control, etc. The color scheme is the invention of Mr. E. G. Desoe, air brake instructor on the Boston & Albany R. R. These charts will be really a practical application of the old adage, "Seeing is believing," as they will, in telling their story, appeal to the eye. There is no more easy way of acquiring information than to have it shown to one. Just as stereoptican pictures enhance the value of a lecture, so will these charts add interest to the whole subject of air brake operation, and will be a decided help to all seekers after information in this important department. These charts will be issued, beginning in the March number.

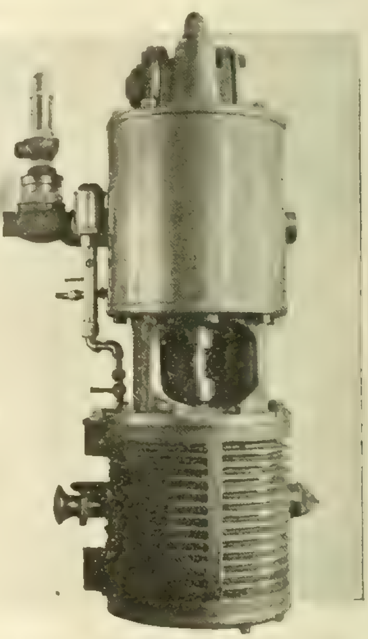
Automatic Sight Feed for Air Cylinder.

I send photographs of my recently patented automatic oiling device for the air cylinder of an air pump, applied to an 8 in. and 9 1-2 in. pump, also a central vertical section of the mechanism.

This device has been put to a severe test for the past thirteen months, and has proven successful in every detail, enabling the pump to produce more air and prolong the life of the pump.

F is the connections of any rod or guide cup, with a fine adjustable feed. G is the drop tube for oil. H is the sight feed tube, consisting of a 3-4 in. by 2 in. lubricator glass. L is the sight feed port. Also a certain amount of air passes through this on the downward stroke of the main piston. I is the upper check valve, seated by the spring J. K are ports leading from the upper to the lower check valve chamber. M is the lower check valve, and is seated by spring N. S is a 1-4 in. street elbow connection.

It will be noted that the vacuum, or partial vacuum, from the main piston opens the valves and the spring closes them before they are reached by the pressure. After thirteen months of service, the valves and seats do not show any perceptible wear. I have had four of these in service, and no repairs have been required. About two tablespoon-



9½ INCH PUMP WITH SIGHT FEED LUBRICATOR.

fuls of valve oil will supply the pump for ten hours. The top lid is hinged, and requires filling every three or four days (or round trips). Opening the feed at commencement and closing at end of the run is all the labor or care involved. The oil reservoir rests against the steam union nut of the governor, which always insures oil warm enough to flow freely.

G. W. Thurston.

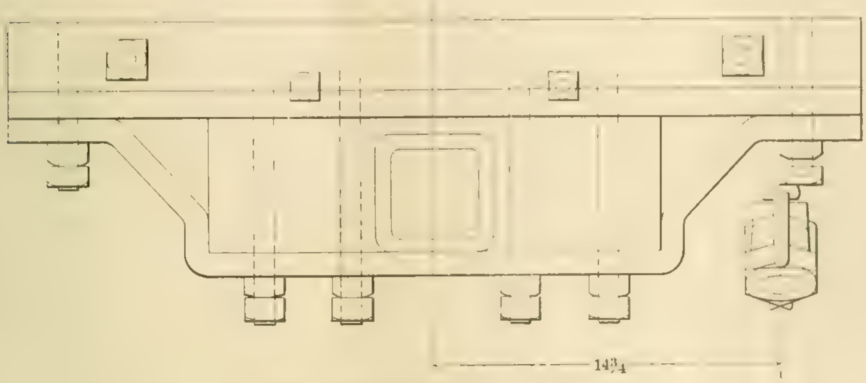
Dunsmuir, Cal.

CORRESPONDENCE.

Dangerous Position of Angle Cocks.

I send you a drawing I made of a dangerous position of an angle cock in relation to the outside drawbar carrier wire bolt.

The drawing is made from a specific case in which the lower nut on this bolt worked down so that one of its corners rested directly on the center of the top of the angle cock plug, and although the train pipe was tight in its clip, there was still vibration enough to cause the spring in the angle cock to compress, and the corner of the nut resting on the plug formed a pivot for it, so that the least touch would move the angle cock handle open or shut. This car was the second one from the locomotive on a long freight train, and the swinging of the car when running closed the angle cock and caused trouble when an application was required.



DANGEROUS POSITION OF ANGLE COCKS.

This train had made a successful stop three miles away from the point at which the trouble occurred, and while very little damage was done in this case, it shows, however, what could happen with the angle cock in such a position. A very large number of the freight cars of many different roads have their angle cocks directly under this bolt in the same way, and are thus liable to the same accident. Besides, it simply shortens up the hose couplings. The standard distance of 13 in. from the center line of one car to the center of angle cock, should be more closely adhered to, and thus avoid the trouble mentioned.

W. C. Hunter.

Gen'l A.-B. Insp'r Intercolonial Railway.

Moncton, N. B.

Triple Valve Fitting and Repairing.

A lot of time is spent answering questions of persons who have a theory to peddle, so if you will kindly give me space in your journal I will try to make clear what should be the requirements of the triple slide valve and its seat, and a few points on fitting them for service, as I am a triple fitter and air brake repair hand at this point.

It is not going very far out of the road to state that the triple valve is to each car as the brain is to each individual, and the actions of either are in most cases in comparison as to their degree of perfection; hence, a perfect triple might be termed an educated triple. The slide valve and seat are the points upon which I wish to focus my remarks, as the other parts are easily finished by machine.

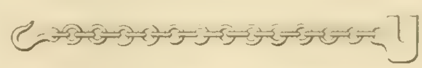
A perfect slide valve seat and an air-tight triple are the cardinal points which should be insisted on, for reasons which are obvious. A sand hole in the slide valve, bushing or leakage under the bushing, are a few of the defects which will allow air to escape, and by a lax test makes it impossible to detect the cause of the leakage. The above added to a defective seat limits the efficiency and service of the triple. An air-tight triple is no criterion as to the perfection of the seat, as my experience will prove. I have tested a number of passenger triples to be used on local trains, and taking the tight ones (such cases are becoming rare) rubbed the slide valve on the seat and found some of them only bearing on the vital points, leaving low places exposed to catch the grit and sand, thus reducing the service of these triples to a minimum; whereas, the seats which had a bearing the full travel of the valve would stay in service for years without any appreciable defect.

What constitutes a good triple valve seat is limited to those who are experienced in fitting them, owing to the peculiarity of a brass to brass slide valve and seat. The slot is cut through the bushing by machine, and the fitter seats the valve by hand. It requires skill and patience to make an air-tight plane across the ports and the full travel of the slide valve. This part of the work is accomplished to-day practically the same way as in the beginning; i. e., by files and scraper. The slot is first filed and the bearing found by a surface strip the width of the slot, a very light film of oil being used on the strip to detect the high places which are scraped, until the surface strip bears all over the seat. Then the slide valve is ground in to match. The life of the valve and seat would be longer if they were scraped to a bearing, but it is not practical on account of the length of time it would require.

There has been divers attempts made to finish this work by machine, but without success. One of the many devices resorted to was on the same principle as the key seat machine with roughing and finishing bars, the necessary parts being made as perfect as possible. A number of triples were slotted, and to the inexperienced fitter seemed good, and afforded considerable elation to those concerned in the experiment. The slide valve was ground to match the seats and they were tested, a few passing the test. The triples were then given to the fitters to be reseated, and upon examination the seats were found wavy and very low across the ports. These conditions were easily accounted for, as three ports (I allude to the Westinghouse triple) are so close together that the most accurate bar will cut low and gouge at this point.

The nature of the metal is another factor which makes this valve seat one of the impossibilities of the machine. If it were possible to grind the slide valve to such a seat and make it partially tight, as stated before, the service of such triples would be limited, and it would be just as practical to take a triple seat that needed repairing and grind a newly surfaced slide valve to match it.

McKee's Rocks, Pa. H. L. S.



SLACK TAKE-UP DEVICE.

Slack Take-Up Device.

I send you a sketch of my device, which is used by air-brake testers and adjusters in the South Pacific car department, Oakland, to take up slack in the bottom rods when necessary, the dead levers having been taken up to the last hole in their stops.

This device saves considerable time usually lost in going to the shop for clamps, it being so small that it can be carried on the brake valve stand; also allowing one man to do the work of two, where clamps are used.

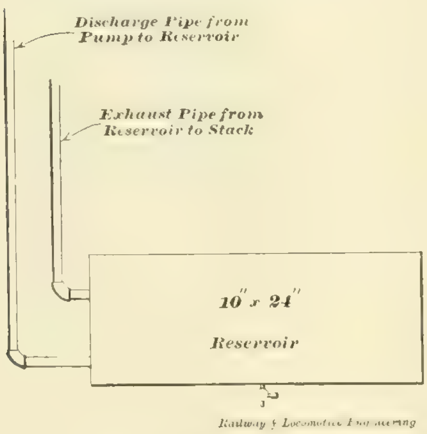
To use the device, push the dead lever to the last hole in the stop and pin, then hook the hook end of the device to the center of the brake beam, and the clutch to the bottom rod, seeing that the chain is taut. Then pull the pin holding the dead lever in the stop; this will throw

the strain from the connection of the lever and bottom rod, to the device. Connection may now be broken, and the lever moved up one hole in the bottom rod, the pin replaced, and the job is done. W. H. COLLINS.
Air-Brake Inspector Sou. Pac. Ry. Car Department.
Oakland, Cal.

Air Pump Exhaust Muffler.

It may be of interest to some of your readers to have me mention an important change I have made in the air-brake instruction car I am in charge of.

We have a 9 1-2-inch Westinghouse pump to furnish the air for use in the car, and as it is necessary to use the air pump exhaust to furnish draft for the boiler, we have experienced considerable trouble with the noise the pump exhaust made.



AIR PUMP EXHAUST MUFFLER.

We were obliged to muffle the exhaust, so I had it piped from the pump to a 10 x 24-inch auxiliary reservoir which was placed underneath the car. From the same end of the auxiliary reservoir I had the exhaust continued to the stack.

This device works very satisfactorily. The only noise in the car now is the valve seating. Thus we still have the use of the exhaust steam for the draft on the fire. I send a rough sketch of the device herewith for illustration.

WM. SHRIVER,
A.-B. Inspr. B. & O. R. R. West of Ohio River.
Allegheny City, Pa.

Instruction Car Kink to Illustrate Broken and Stuck Air Pump Valves.

On the 9 1-2-inch pump I use to furnish air for our air-brake instruction car, I have the bottom receiving valve and bottom discharge valve so arranged that I can unseat the valves to show the effect of stuck or broken valves.

The device I use to unseat the valves is a stuffing box and a valve steam of a 1-2-inch globe valve. I had the valve cages tapped so as to screw into the bottom of the cages, thus I can show the effect of oiling through the air inlet and can hold the valve off the seat and also show the effect of a stuck valve.

The stem on the discharge valve side has threads to raise the valve from its seat to show a broken discharge valve. This arrangement is very simple and instructive, and can be very easily arranged.

WM. SHRIVER,
A.-B. Instr. B. & O. R. R. West of Ohio River.
Allegheny City, Pa.

Reversing Engine with Brakes Set.

My opinion of the subject of drivers sliding with engine reversed, is that it is never good policy to reverse an engine if the brakes are holding at all, for as soon as an engine is reversed, the drivers start to revolve in the opposite direction, and the brake shoes seize the wheels and hold them, causing flat spots, etc., regardless of whether the speed is high or not. I have seen this take place under these conditions.

W. G. STENASON.
Hamilton, Ont.

Reducing Valve Testing Device.

I send you a sketch and directions how to use a simple device which I employ to test the high-speed reducing valve of the high-speed brake.

The device consists of one air gauge, two three-eighth inch cocks, and nipples and fittings which, when put together, will conform with the sketch.

The nipple at cock D should have the female part of union I on it; also the same at tee B.

The hose G should be long enough to reach the air plug in the yard, with air coupling on one end, and male part of three-eighth union at the other.

Filling hose H is four feet long, with one-half inch nipple at one end and male part of three-eighth union at the other.

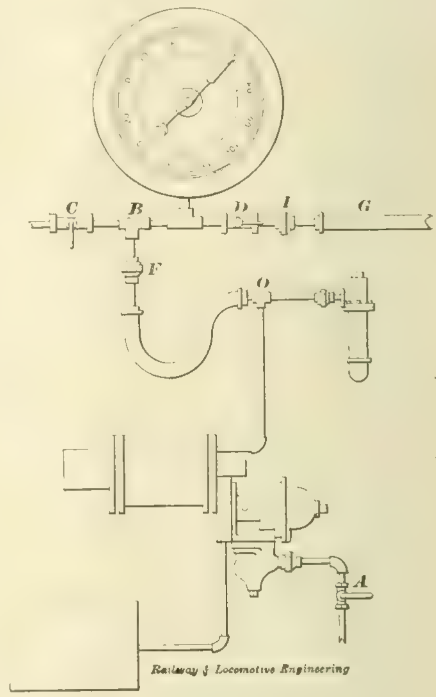
To use the device, couple the hose G to the air plug in the yard, and tester to hose at union I. Close cock D, take the plug out of tee O in the reducing valve pipe, and screw the filling hose to it and the other end to the tester at the union F, and close cock C.

Now see that all air is out of brake system, and close cock A. Then open cock D and the air from hose G will pass to gauge, brake cylinder and reducing valve. At the same time, there will be a blow at the triple exhaust, but leave it alone, and in about one minute open cock A. This will cause the triple to go to the full service position and the blow will stop. Leave cock A open, and when the gauge shows the required pressure to cause reducing valve to exhaust, set your valve. The valve being tested and adjusted, close cock D and open cock C. This will allow the air in the brake cylinder and reducing valve to escape to the atmosphere, and you may disconnect the filling hose, replace plug in tee O, and call the job done.

W. H. COLLINS.
Air Brake Inspector S. P. Car Dept.
Oakland, Cal.

Emergency Tests of Air-Brakes.

There appeared in the January number of this paper an article entitled "Emergency Tests of Air-Brakes," which, I presume, the writer intended to be a reply



REDUCING VALVE TESTING DEVICE.

to my article on this subject in the December number. Besides that which I have already covered in what I have written on the subject, I find very little of any importance to answer. However, in regard to the point, which I think the author intended to bring forth, that there would be difficulty experienced in ascertaining if a serial application took place on a 50-car train, I will say that on roads which have a complete code of hand signals in use to communicate from one end of the train to the other, when testing the air-brakes, it would not be difficult to ascertain this. And as for the time required, I think it would not be over 30 seconds.

E. G. DESOE,
General A.-B. Inspector B. & A. R. R.
Springfield, Mass.

The Baldwin Locomotive Works have made an offer to the Sibley College of an experimental locomotive, and the authorities of the above universities are making preparations for the installation of the engine.

The Pressed Steel Car Company have made an announcement that they will share the profit of the business with their employees.

QUESTIONS AND ANSWERS

On Air Brake Subjects.

(8) D. J. McC., Savannah, Ga., asks:

Will leaking gland nuts on the piston rods of the New York duplex pump have any effect on working the head loose? A.—Yes, and especially so if the pump is run at a rapid rate. At the end of the upstroke the pump will lose its cushion, and the piston head will be permitted to strike against the center piece of the pump, thus causing the piston head to work loose from the rod.

(9) M. M. D., Albany, N. Y., asks:

Will we get any better signal on the engine by holding onto the bell cord in the car and keeping the discharge valve open a long time? A.—No better, nor as good a signal, will be had as if a short, sharp, quick pull of the cord is made, thereby venting pressure at the discharge valve sharply and quickly. Again, the longer pull of the cord will interfere with the succeeding signal.

(10) J. B. M., Hempstead, L. I., writes:

1.—One of our six-car passenger trains has been cut down to two cars since the summer travel is over, and the ten-wheeler that hauled the six-car train now hauls two cars only. We have had trouble in two instances from slid flat wheels on the two-car train, but none on the six. Why is it? A.—1. The unbraked weight of the engine is much greater than that of the cars. In other words: the cars are now helping to hold back the engine in making stops, besides doing their own work. The work of the two cars in doing this is much greater than in the six-car train, thus overtaxing the wheels on the two cars and causing them to slide.

2. Wouldn't a brake on the truck wheels of the engine help out some? A.—2. It certainly would.

(11) J. B. C., Port Jervis, N. Y. asks:

Why does the piston rod on an 8-inch pump break off so often in the air piston? I have noticed that there are more breakages on the rod at this point than at the upper end. A.—Oftentimes a wide open pump throttle, when the air pressure is low, will cause a piston head to strike against the center piece of the pump, thus causing an undue strain on the lower end of the rod where the thread ends. Another prime reason is the efforts of the repairman to tighten up the nut on the lower end of the rod with a hammer and chisel after taking off the lower head when the pump is still on the engine. In this case he is unable to get a wrench on the nut, and the result is that the rod is weakened at end of the thread and finally breaks off. It will be observed that where broken rods occur most frequently that chisel marks may be found on the nut.

(12) P. J. F., Oelwein, Iowa, asks:

Can you give a rule by which I can find the size of air drum to hold a volume of air at 90 lbs., which is contained in a drum at 110 lbs.? A.—The capacity in inches contained in a given reservoir multiplied by the pounds pressure in that reservoir must equal the capacity in inches multiplied by the pounds pressure of the other reservoir. If three of the terms are given, the fourth can be found. In this case, we have the three terms to help us find the fourth. We will assume that the reservoir containing the 110 lbs. has 16,000 cubic inches capacity. By multiplying 16,000 by 110, and dividing by 90, we get the capacity of the reservoir in which we wish to hold the air at 90 lbs. pressure, which is 19,555 cubic inches. The general rule, then, is, multiply the known capacity of one reservoir by its pressure, and divide by the pressure of the other reservoir. The result will be the cubic capacity of the second reservoir. Similarly, if the pressure and capacity of one reservoir and capacity of the second reservoir is known, and the pressure of the second reservoir is desired, we would multiply the capacity of the known reservoir by its pressure, and divide by the capacity in inches of the other reservoir. The result would be the pressure required.

(13) E. L. R., Jersey City, N. J., writes:

Is the automatic brake on a switch engine as good as a straight air-brake? Doesn't it apply too slow and release too slow? We have an engine here which "spots" cars on a float at the dock in North river, and when we get a signal from one of the yard crew to stop we find the automatic brake too slow—unless we throw it into the emergency. We often make a stop by reversing the engine. In a case like this where accurate stopping of the cars is required, would it not be better to use the straight air direct? A.—The automatic brake is not as satisfactory a brake for switching service as a straight air brake. However, switch engines so frequently couple up and handle air-brake trains that it has proved impossible to remove the automatic brake on engine and put on the straight air brake. Recently a combined automatic and straight air brake for switch engines has been designed by the Westinghouse Air Brake Co. which answers both kinds of service admirably. The straight air feature consists of a few parts which may be quickly added to the automatic. Thus a switch engine may be equipped to operate with either an automatic or straight air brake. See illustration of this in November issue.

(14) C. W. A., Youngstown, O., asks:

Don't the brake beam springs on brakes take away a lot of the brake power that should go to the wheels? Yesterday in taking up slack on the dead lever I found the resistance of the beam springs so powerful that I had to get a chain and run it around the axle and the beam to get a dead lever pin in. A.—A surprising amount of the force which should go to the wheels is absorbed by brake beam springs. These springs are most common on outside-hung brakes, and seem to be growing stiffer and stiffer as the car grows larger and heavier. A series of tests was recently made to determine the friction in the parts of the foundation gear and the resistance of brake-beam springs. A reduction of five pounds in train pipe showed nine pounds in brake cylinder and only 200 pounds on brake beam, while the estimated pressure on the beam was 828 pounds, or a loss of 76 per cent. A reduction of 10 pounds showed 21 pounds cylinder, and 950 pounds brake-beam pressure, against an estimated pressure of 1,931 pounds, or a loss of 50.8 per cent. A 15-pound reduction gave 29 pounds cylinder and 1,600 pounds brake-beam pressure, against 2,667 pounds estimated, or 40 per cent. loss. On the emergency application this percentage of loss was reduced to an average of about 31 per cent., due to the sudden shock when the brakes were set.

(15) J. B. McD., Buffalo, N. Y., writes:

Recently I had the privilege of witnessing a test made with a six-car passenger train, equipped with high pressure reducing valves, to determine how much pressure over sixty pounds could be had in the brake cylinders in a continuous service application—this being the kind of service application an engineer makes when he thinks he is going to overshoot the station, or run by as some term it. It was found that the pressure in all those brake cylinders run up seventy pounds, and in one case, seventy four before the reducing valve opened. It then blew for some seconds and finally closed off at about sixty pounds, there being a variation of two or three pounds in the point of closure among the different valves. Will you explain how it is that with these valves the points of opening and closing are so wide apart, and why the valve that closes at sixty pounds, does not open promptly at sixty? A.—The difference between the opening and closing pressure is due to the fact that the piston seats against an annular lip on the upper part of the cylinder, thus leaving less piston area exposed to the incoming pressure. As soon as the piston starts to descend, however, the full area of the face of the piston is exposed, and the closing of the valve will be at sixty pounds, or whatever pressure the closure is adjusted to. The difference in the opening and closing pressures will sometimes run as high as eight or ten pounds, but will gradually reduce to a minimum as the parts become worn to their seats.

Rogers Consolidation for the T. & O. C. Railway.

The Toledo & Ohio Central Railway recently received 20 heavy consolidation engines from the Rogers Locomotive Works at Paterson, N. J. These engines are simple with cylinders 20x26 in. The driving wheels are 54 in. in diameter and there is 133,000 pounds resting upon them. The total weight of the machine is 150,000 pounds. With 180 pounds steam pressure, the calculated tractive force which can be exerted is about 29,500 pounds, and the ratio of adhesive weight to tractive force is 4.5. The leading pair of drivers are equalized with the pony truck, and the three rear drivers are equalized together with coil springs in front and rear and semi-elliptic springs placed between the wheels and between the frame bars. The second driver is the only one not flanged. The valve motion is indirect, the transmission bar here takes the form of an arched steel casting, with bolt and filler below the axle of the second driver.

The boiler has a Beipaire firebox and tapers from dome to smoke box, the smallest diameter being 60 in. The pop valves are placed in the top of the dome and the whistle occupies a somewhat protected position behind the dome. The frame cross bracing has been well looked after, there being a large steel casting back of the cylinders, and the arrangement below the cab is very substantial. The tender frame is made of white oak, and the tank, which holds 5,000 gallons of water, is finished very neatly with a deep coping which helps to hold coal, and which does not enclose the manhole. A low railing around the edge serves as a sort of guard around the edge of the tank. A few of the principal dimensions are as follows:

Cylinders, 20x26 in. Drivers, dia., 54 in.
Driv. journals, 8x10 in. Driv. wheel base, 15 ft.
Total wheel base of engine, 23 ft.

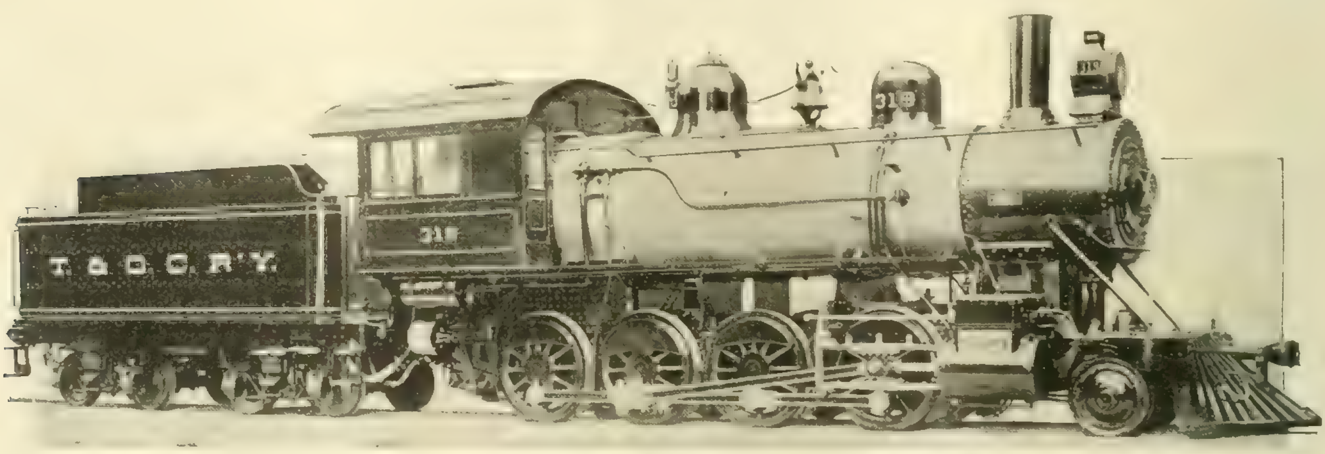
Weight on drivers	133,000 lbs.
Weight on truck	17,000 lbs.
Total	150,000 lbs.

Heating surface, tubes	1760.04 sq. ft.
Heating surface, firebox	165.74 sq. ft.
Total	1925.78 sq. ft.

Grate area, 30.34 sq. ft.
Tubes, dia., 2 in. o. d., length, 15 ft. 10 in., thickness, No. 11 gauge; total number, 243.

BOILER.

Dia., outside front, 60 in.; working press., 180 lbs.
Thickness of barrel, 9/16 in.; dome course, 5/8 in.; crown, 3/8 in.; tube, 1/2 in.; side, 5/16 in.
Tender, capacity, 5,000 gals.; frame, white oak; trucks, diamond arch bars



ROGERS CONSOLIDATION FOR TOLEDO & OHIO CENTRAL.

Modern Results from an Old Machine.

That an up-to-date idea and an up-to-date result may be successfully combined on a machine which has looked the scrap heap seriously in the face at close quarters, may be seen any day in the Rogers Locomotive Works. The up-to-date idea is the rapid, accurate and cheap method of making the "square" on the ends of stay-bolts so that they may fit the socket of the threading machine or fit a wrench in the boiler shop. The up-to-date result is seen in the stay-bolts themselves, and the machine in question is an ancient slotter, whose declining years are crowned with such a measure of usefulness as a modern tool might envy.

The table of the slotter remains permanently fixed, as the feed mechanism has long since "gone in," while bolted to the table is what may be called a large cast iron die with a pair of jaws. In this die there works a ram which is guided or steadied by the die. The front of the ram carries a rib so that in section it would be something like the letter T. This rib is cut off some distance from the bottom of the ram, and anything pushed up against the face of the ram would be forced downward when the cut-off end of the rib came down on it. That is exactly what happens to a stay-bolt end when it "goes up against" the descending ram with its cut-off rib. On either side of, and close to, the path of the vertically moving rib are two dies, with faces slightly tapering in the form of a V. These dies have each seven notches, with cutting faces along their edges. The stay bolt, as it is carried down by the butt-end of the rib on the ram, is forced past these cutting edges, with the result that they literally cut off two semicircular cheeks from the stay-bolt end and at the next stroke eat off two more half-round cheeks when the operator has given the bolt a quarter turn. The depth of the teethed dies and the pushing rib is about an inch, so that the end of each stay-bolt, as it is tossed into a heap, has been cut square for that distance, and of uniform size and without taper. Two strokes of the remodeled slotter, which is running continuously, does the work on each bolt. The operator does not hold the bolt itself in his hands; he fits it in a socket and tightens a set screw. The socket is in the end of a long hollow bar, which has its farther end loosely but permanently held in a rest while the stay-bolt is in the machine. When completed, socket and bar are moved out, and while the far end of the bar remains in its rest, the socket end is placed in a temporary rest while one bolt is removed and another put in.

There is no burned iron by this process and no expense for the fuel of a furnace. The cost of the doing the work is that of operating the machine, keeping it in service and paying an unskilled workman, and the result is decidedly up-to-date, though the instruments are not at all modern. That is the kind of thing to which Captain Cuttle's maxim applies: "When found, make a note of."

We are informed that the Stannard & White Co.'s patents will be manufactured by the Gold Medal Camp Furniture Mfg. Co., Racine Jct., Wis. Hereafter all letters, orders, etc., intended for the Stannard & White Co. should be addressed to Racine Jct., Wis., where they will receive careful and prompt attention.

How to Handle Gasolene.

BY E. W. ROBERTS

As many of our readers have to handle gasolene and kerosene and have very vague ideas about the dangers of explosion, we reproduce this valuable article by an excellent authority from the pages of *The Automobile Magazine*, of New York.

Why is it that a man who will handle gunpowder with impunity, who would not hesitate to set fire to a small quantity of the powder strewn upon a board, will blanch at a suggestion to do the same thing with gasolene? This same man will shoot all manner of fireworks in commemoration of the nation's birthday or upon other momentous occasions, yet were some one to touch a lighted match to the opening of a can filled with gasolene, he would make a break for tall timber. Even those who are quite familiar with gasolene and have handled it considerably as operators of gasolene engines would be inclined to hesitate before performing the experiment illustrated in Fig. 3. It would seem that this uncalled for fear of gasolene is caused by the fact that a bad reputation is easily acquired but difficult to shake off.

Gasolene is that one of the series of petroleum products which is given off, during the selective distillation of the crude material, just between benzine and kerosene. Gasolene as employed for gasolene engines is comprised in that series which is known to the oil trade as C-petroleum-naphtha. This series includes those oils which have specific gravities lying between .667 and .707, or, as they are more frequently distinguished, between 80° and 68° Baumé. The boiling points of the oils classed as C-petroleum-naphtha lie between 176° and 212° Fahr. Gasolene, therefore, is lighter than water, and vaporizes readily at ordinary temperatures. For gasolene engines the fuel employed is usually 72° (Baumé), or stove gasolene, and that used for steamers generally 76°.

Gasolene itself is a chemical compound of hydrogen and carbon, as are kerosene, benzine and the remaining petroleum derivatives, and is known as a hydrocarbon. It will unite with oxygen to form water and carbon monoxide, the process of this union being known as combustion. In order to start combustion the temperature of the fuel must be raised to the temperature of ignition, when combustion will take place at the surface in contact with the oxygen, usually that contained in the atmosphere. The heat of combustion of one portion of the liquid raises an adjoining portion to the ignition temperature, and so the combustion continues from one particle to the next. The rapidity with which combustion takes place depends upon the extent of the surface exposed to the air and also upon the rapidity with which the products of combustion pass away and give room for fresh air. When both the air and the fuel are thoroughly mixed, the combustion is so rapid as to become explosive, as in the cylinder of a gasolene engine. An excess of either air or fuel in a confined space dampens the explosion, and when the proportion passes a certain point an explosion will not take place. It is seen, therefore, that both air and heat are necessary to produce an explosion, and that, unless air be present, gasolene will neither burn nor explode. Again, the liquid will not explode even in the presence of air, unless the air and the combustible are intimately mixed. This is the reason that in the series of experiments illustrated herewith, no explosion takes place.

In Fig. 1 is shown a common oil can containing about two-thirds of a gallon of gasolene, to opening of which the writer is holding a lighted match. No explosion follows this apparently foolhardy procedure, since the comparatively rapid evaporation of the fuel has driven all air from the top of the can above the liquid, and this space contains only gasolene vapor unmixed with air. The gasolene vapor takes fire and burns at the mouth of the can in exactly the same manner as gas burns at a gas jet.

Fig. 2 shows how the flame may be extinguished without trouble or danger by dabbing the mouth of the can with a handkerchief. Even a quick stroke with the bare hand will often suffice, and such was the method used to extinguish the flame after some of the experiments illustrated.

The experiment shown in Fig. 3 makes one think of that incident famed in the joke book, "Bridget" lighting the fire with kerosene. Had Bridget taken the cap off the can she would not now be numbered with the angels. Since kerosene evaporates more slowly than gasolene, the top of a kerosene can is likely to contain an explosive mixture of kerosene vapor and air. If the mouth of the can be open, there is ample exit for the products of combustion should such a mixture take fire, although the agitation of the contents due to pouring will usually cause the formation of enough vapor to drive the air from the top of the can. In performing this experiment a small quantity of gasolene was poured upon the top of the lower can to accentuate the flame. This gasolene is ignited and the liquid is poured from the spout can directly through the flame into the other can. A moment's consideration will show that there is not the slightest danger in the performance of this experiment. The stream of gasolene will ignite, but it will be extinguished so soon as it passes into the lower can, where it is out of contact with the air. The gasolene on top of the can soon burns itself out, and the flame at the mouth of either can is readily extinguished by a stroke of the hand.

This experiment is, in a way, the clue to the cause of many gasolene stove fires. Filling the stove while the jets are burning is not to be recommended, but when it is done and a small quantity of the liquid is accidentally spilled, the flame is sure to rush to reservoir, and the frightened individual filling it drops the can and flees. A conflagration naturally follows, and the newspapers report it as a gasolene explosion, when it is very unlike-


1


2


3

ly that an explosion took place. It is a gasolene fire due to carelessness and ignorance of what to do in an emergency of this kind.

You have probably heard the oft-quoted fable of gasolene fires due to the spark from a lighted cigar or a lighted cigarette. Try as hard as you will, you cannot ignite gasolene or its vapor with the spark of burning tobacco unless a flame be present. The pan in Fig. 4 is half full of gasolene, and I am smoking a cigar as fast as I can with the end held just over the surface of the liquid, as is shown by the smoke. In Fig. 5 the experiment is shown repeated with a cigarette. It is simply a question of too low a temperature in ember of the tobacco to ignite the hydrocarbon.

Fig. 6 shows a lighted cigar being plunged into the same pan of gasolene, and in Fig. 7 the same cigar has been lighted and is flaming on account of the gasolene it has absorbed. If the flame is blown out, the cigar will smolder, but will not flame up again.

The cigar in Fig. 8 has first been lighted, and when it was burning nicely it was saturated with gasolene by dabbing the liquid on with the finger. Being accustomed to the taste of gasolene, the writer suffered no inconvenience from the added flavor. The photographer gracefully declined when I offered to add a similar bouquet to the cigar he was smoking.

The most effective way to extinguish a gasolene fire is with a substance that will stop access of air to the combustible, i. e., smother the flame. Since gasolene is lighter than water, it will float on the surface of the latter, and an attempt to extinguish it with water usually results in spreading the flame. In Fig. 9 is shown a small quantity of gasolene floating and burning on top of water. A forcible stream of water will, however, practically blow out the flame and prevent, by wetting surrounding substances, the spread of the fire to them.

Flour, earth or sand will absorb the liquid and prevent it from spreading, as shown in Fig. 10, where a gasolene fire is being extinguished with flour. Aqua ammonia is also a good extinguisher for gasolene fires, and a large bottle of it dashed upon the floor of a room will often put out quite a stubborn blaze. It is scarcely advisable to remain in a room in which any quantity of ammonia has been set free.

While the foregoing experiments show that many of the assumptions in regard to gasolene are unfounded, the writer has no intention of claiming that gasolene should not be handled with care. A gasolene can will explode if it contains a few drops of gasolene and a large quantity of air, and such an operation as warming an empty gasolene can before a fire is likely to result in an explosion. A tightly closed can containing a quantity of gasolene, if exposed to heat, will have pressure generated therein exactly in the same manner as steam is raised in a steam boiler, but at a much lower temperature. If this pressure exceeds the strength of the vessel, it will burst, but should no flame be present a conflagration will not follow. If a large quantity of gasolene escapes from a leaking vessel into an enclosed space such as a room its vapor will in time fill the room with an explosive mixture with the air, and if this mixture be ignited a disastrous explosion is sure to follow.

Gasolene fires pure and simple, without the element of explosion, are most productive of the disasters due to gasolene. Like water, a quantity of gasolene spilled upon the floor will spread over a large space, and if accidentally ignited the flame will cover the entire surface in an exceedingly short space of time. It is in this rapid spread of the flame that lies the chief danger from a liquid fuel. If it is spread upon merely an open space where there is nothing above it for the flame to ignite, the best way is to leave it alone, as it will burn itself out and not even char the board. If there is danger of the flame coming in contact with anything above it, it should be smothered with cloths, blankets, loose sand or earth, or with flour. Water should be used only as a last resort, and with the greatest caution, so as not to cause the fire to spread.

For storing gasolene the tank should be placed so that it will be kept comparatively cool and on no account exposed to the direct rays of the sun. This is not so much to prevent danger from fire as it is to prevent waste from evaporation. Probably the most convenient and effective way of storing gasolene is to bury the tank about a foot below the surface of the ground. It then may be piped to a pump in the stable or garage, and all pipe connections should be carefully made and the threads lubricated with soap or painted with shellac or some substance that will not be attacked by gasolene. Leaks should be avoided not only to prevent waste, but also to prevent the escape of any great quantity of vapor into any enclosed space where it may form an explosive mixture with air.

4

5

6

In case any great quantity of gasolene is to be handled no flame of any kind should be in close proximity, not that there is any danger in the simple operation of pouring gasolene from one can to another in proximity to a flame, but the danger comes from likelihood of the gasolene being spilled and forming a highly inflammable surface. There is, however, no necessity of handling gasolene with the same precautions as one would take with gunpowder, as the two substances are by no means analogous. The same precautions that are usually taken with kerosene are generally sufficient, the only difference between the two substances being that gasolene evaporates more rapidly at ordinary temperatures. No one would think of filling a burning lamp with kerosene, especially if the vapor were so volatile as to almost instantly reach the flame of the lamp and take fire. Again, if a kerosene lamp takes fire one does not usually run from it, but tries to throw it out

doors as quickly as possible. It should be remembered that, if a vessel containing gasolene takes fire and there is any danger of explosion, the explosion will occur immediately following the ignition, and not later, and it is foolish to run away. The proper thing to do is to make every effort to get the vessel out doors, and it should be carried by walking backwards so that the flame will not burn the operator. As, for instance, if the vessel is a pail that is being carried on a poker. In conclusion, it may be said that a little horse-sense in an emergency of this kind does a great deal more good than a whole lot of fuss.

Electrically-Operated Oil Circuit-Breaker for High Tension Circuits.

The rapid increase during recent years in the size of central stations and the currents and voltages handled therein has brought about a great development in the methods and apparatus for controlling and switching electric currents.

It is to meet the need of a compact, safe and reliable device for rupturing high-tension circuits that this oil circuit-breaker has been brought out.

The circuit-breaker is erected in a masonry structure with each pole and oil tank in a separate, fireproof compartment. The movable contact for each pole consists of a U-shaped piece of copper fastened to the end of a stout wooden rod. In the closed position of the switch, one of these U-shaped pieces electrically connects the two stationery contacts of each pole.

The toggle joint which automatically locks the system of levers when the circuit-breaker is closed is released by a blow from the tripping magnet, whereupon the cross bar under the influence of gravity, and a powerful spring, quickly drops, opening the contacts. The break takes place first at the main contacts and then afterward at a removable plug attached to the stationery contact which enters a hole on the movable contact. The plug thus receives all the effects of any arcing that there may be and, since it is removable, is easily replaced.

The tanks are insulated from the circuit, and, all the live metal parts being immersed in oil, there is no possibility of receiving a shock from touching the breaker.

The controlling and indicating devices consist of a controlling switch, an electro-mechanical tell-tale indicator and a lamp. These are suitably mounted at the operating platform.

The controlling switch has three positions, namely, "closed," "off" and "open." It will remain of itself in the "off" or the "open" positions only. In the "off" position it connects the control circuit so that if the oil circuit-breaker opens through the action of any of the automatic devices the lamp will be lighted on the operating stand to attract the operator's attention. If the oil circuit-breaker is opened by the operator throwing the controlling switch to the "open" position, the lamp does not light. The mechanism of the electro-mechanical tell-tale indicator consists of an electro-magnet which attracts a pivoted armature through an angle of about 90 degrees. Attached to the armature is a disk with a pointer which indicates to the eyes the "open" or "closed" position of the oil circuit-breaker.

E. W. ROBERTS.

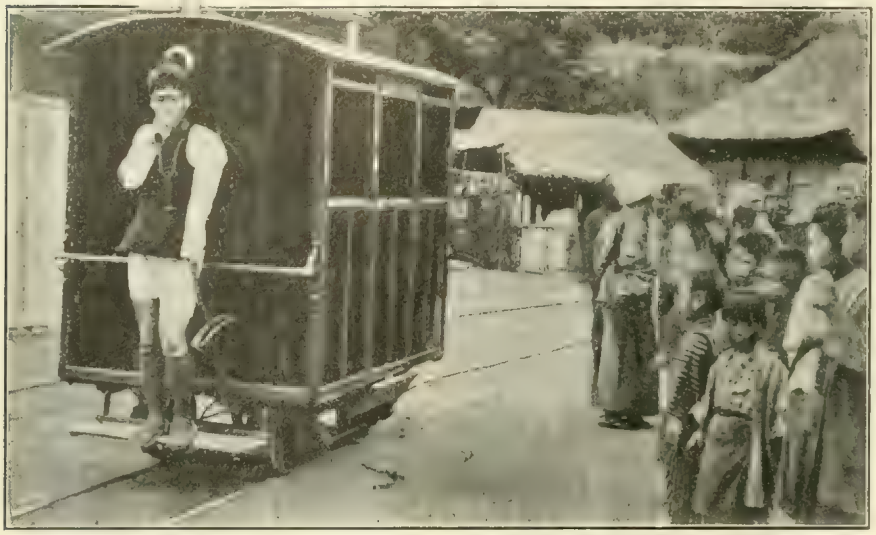
The apparatus described above, known as the "Type C Circuit-Breaker," is manufactured by the Westinghouse Electric & Mfg. Co.

Car Building Is Brisk.

A good idea of the activity prevailing in the steel car business is shown by the fact that Robert W. Hunt & Co., of New York, have been given the inspection of 350 steel ore cars, to be built by the Pressed Steel Car Co. for the Duluth, Missabe & Northern, and 450 similar pressed steel cars for the Duluth & Iron Range Railroad. In addition, they have a small order of 75 flat and box cars, to be built at Hegewisch, Ill., to inspect for that railroad company. They also have been instructed to inspect 500 steel underframe box cars, to be built at Berwick, Pa., for the Philadelphia & Reading, and 500 steel hopper coal cars for the same road, to be built at Butler, Pa. They have just been given the inspection of 1,600 box and 500 stock cars, with pressed steel underframes, to be built at Hegewisch, Ill., for the Southern Pacific Railroad, and 1,000 flats, with pressed steel underframes, to be built for the same company, by the Pressed Steel Car Co., at their McKee's Rocks plant. They are engaged upon the inspection of 300 gondola cars for the Bellington & Beaver Creek R. R., at Jeffersonville, Ind., and 110 coal cars for the East St. Louis & Suburban R. R., to be built at Madison, Ill. The firm also report their locomotive inspection department to be very busy at the various works. They have just received instructions to inspect 27 locomotives at the Baldwin Locomotive Works for the Wheeling & Lake Erie Railway, and they have been given an additional order by the Hocking Valley Railroad Company for the inspection of 12 switching engines, to be built at the Brooks Works of the American Locomotive Company.

The Two-Man Power Railway.

Coolie labor is very cheap in the Far East, and as men devour less than horses, probably this fact accounts for human "beasts of burden" being so very common. The illustrations which we give herewith are views of which is probably one of the smallest and most curious practical working railways in the world. The traction is not furnished by either petrol, steam or electricity, but by human propulsion; so that it is literally accurate to describe this little locomotive as being of "two-man power." The line connects the little Japanese watering place called Atami with the town of Yoshihama, in the province of Izu. It is about twenty English miles in length, and runs through picturesque and characteristically Japanese scenery. The guard in the front is furnished with a horn and brake to warn the passersby or stop the tiny train when going down hill. Occasionally the two men in charge have to push the car, but for the most part it runs easily down a sort of natural switchback railway, which is more or less the handiwork of Dame Nature herself. One style of car contains first class accommodations, while another is for second class fares only. We reproduce the pictures and description from the *Car*, London.



TWO-MAN CAR.

TWO-MAN CAR.

A Mikado Goes to the Santa Fé.

The Atchison, Topeka and Santa Fé have recently received from the Baldwin works some heavy 2-8-2 engines for freight service which the Baldwin people call the Mikado type. They are Vauclain compounds with 18 and 30x32-in. cylinders, the low pressure being on top. The drivers are 57 in. and have an adhesive weight of 200,000 lbs. The total weight of the engine is 260,000 lbs. The boiler pressure is 225 lbs. and the engine can exert a calculated tractive effort of about 55,500 lbs. The ratio of adhesive weight to tractive power is 3.6. The boiler is 78 3-4 ins. at the smoke box end and tapers from the dome. The pops are carried in a small auxiliary dome and the whistle is laid down flat on its side so as to gain height. The heating surface is ample, being 210.3 sq. ft. in the firebox, 5,155.8 sq. ft. in the tubes, of which there are 463, thus making a total of 5,366.1 square feet. The grate area is 58.5 sq. ft.

All the wheels are flanged and the connecting rod is of I-section. The two front driving wheels are equalized with the pony truck and the two rear drivers, and the carrying wheels at the back are equalized together. The rear truck is radial, and swings on a center 58 1-8 ins. in front of the axle. The main valves are of the balanced piston type and are placed between the upper and lower bars of the frame front.

The tender tank has a sloping fuel space and a water bottom, and carries 7,000 gallons. The frame is made of steel channels and the trucks are of the ordinary diamond pattern. The appearance of the whole machine betokens a substantial design which shows that the engines are intended for hard, heavy work and plenty of it.

The Department of Agriculture has been investigating the hardy catalpa tree and they have found out enough about its durability that they are advising farmers to cultivate it. The timber is wonderfully durable. The wood is particularly valuable for fence posts, telegraph poles and railroad ties, as it has shown no signs of decay after being in the ground thirty years. If farmers in the treeless regions follow the advice of the U. S. Agricultural Department the places destitute of timber will soon be covered with growing trees. This will not only make a profitable crop for farmers, it will exert an excellent climatic effect that will confer much benefit to the whole country.

"Well, sir," said the railway superintendent to a forlorn-looking man who had gained admittance to his office, "what do you want?" "I would like a situation on your line." "There is no place for you, I am afraid." "There is a place, I want to be interpreter." "Interpreter?" "Yes, sir; to tell the passengers what the trainmen say when they call out the names of the stations."

Of Personal Interest.

Mr. M. McDonough has been appointed road master on the Texas Pacific, with headquarters at Marshall, Texas.

Mr. C. N. Mousserat has been appointed engineer of bridges on the Canadian Pacific, vice Mr. H. E. Vautelet, resigned.

Mr. J. G. Taylor, acting superintendent at Brandon, Man., has been appointed acting road foreman of engines on the Rome, Watertown & Ogdensburg, vice Mr. Geo. Hay, promoted.

Mr. Frederick Bradley has been appointed superintendent of Sierra Railway of California, with office at Jamestown, Cal., vice Mr. W. C. Potts, resigned.

Mr. F. D. Havens has been appointed purchasing agent in charge of the material and supply department of the Louisiana & Arkansas Railway, with office at Texarkana, Ark., vice Mr. J. A. Buchanan, resigned.

Mr. W. J. Kuhn has been appointed roadmaster on the St. Louis & Hannibal Railway, with headquarters at Hannibal, Mo., vice Mr. H. R. Buckwald, resigned.

Mr. C. L. Goodhue has been appointed foreman of car repairs on the Atlantic Coast line for the Jacksonville district, with headquarters at the Sanford shops.

Mr. G. K. Joughins, mechanical superintendent of the coast lines of the A., T. & S. F., has had his headquarters moved from San Bernardino to Los Angeles, Cal.

ROGERS ERECTING SHOP.—BIG C., B. & Q. ENGINE HANGING IN NILES CRANE.

division superintendent on the same road at that point.

Mr. M. C. Byers has been appointed assistant engineer maintenance of way on the B. & O., succeeding Mr. J. B. Dickson, promoted.

Mr. A. E. Long has been appointed superintendent of the Kalispell division Great Northern Railway, with headquarters at Kalispell, Mont.

Mr. W. A. Brown has been appointed superintendent of the Canadian Northern, with headquarters at Winnipeg, vice J. F. Arudel, resigned.

Mr. C. P. Estes has been appointed

Mr. E. O. Smith has been appointed master mechanic on the St. Louis & Hannibal Railway at Hannibal, Mo., vice Mr. M. T. Phillips, resigned.

Mr. Robert Patterson has been appointed master mechanic at Ridgway, Colorado, on the Rio Grande Southern, vice Mr. John Schlacks, resigned.

Mr. G. W. Berry has been appointed trainmaster and Mr. W. E. Wheelock assistant trainmaster on the Cincinnati, New Orleans & Texas Pacific Railway.

Mr. James McNaughton has been appointed general superintendent of the Schenectady plant of the American Locomotive Company vice Mr. F. J. Deems, resigned.

Mr. H. Miller has been appointed superintendent of bridges and buildings on the Cincinnati, Hamilton & Dayton, with headquarters at Lima, Ohio, vice Mr. C. M. Overly.

Mr. H. J. Helps has been appointed master mechanic in charge of Plattsmouth

shops of the Burlington & Missouri River Railroad in Nebraska, vice Mr. D. Hawksworth, resigned.

Mr. R. L. Doolittle, foreman of the Chattanooga shops Central of Georgia Railway, has been appointed assistant master mechanic, with headquarters at Chattanooga, Tenn.

Mr. W. H. Starr has been appointed superintendent of the Chattanooga division of the Cincinnati, New Orleans & Texas Pacific Railway, vice Mr. G. W. Berry, assigned to other duties.

Mr. E. F. Grable has been appointed supervisor of bridges and buildings on the Yazoo & Mississippi Valley with headquarters at Memphis, Tenn., vice Mr. Hubbard, resigned.

Mr. Geo. H. Emerson, general master mechanic of the Western District of the Great Northern, has been appointed superintendent of motive power, with headquarters at St. Paul, Minn.

Mr. John Brown has been promoted from the position of master mechanic of the Autofagasta & Bolivia Railway, Chili, to that of locomotive and car superintendent of the same road.

Mr. C. J. Bolinger has been appointed general foreman on the Atlantic Coast line of the Jacksonville district, second division, with office at Sanford shops, vice Mr. Geo. McDonald, resigned.

Mr. Grant Hall, master mechanic of the Pacific division of the Canadian Pacific Railway at Revelstoke, B. C., has been appointed assistant superintendent of rolling stock of the lines east of Fort William.

Mr. Thomas J. Clark, heretofore traveling engineer on the Great Northern, has been appointed master mechanic on the same road, with headquarters at Everett, Wash., vice Mr. Kelly, promoted.

Mr. A. C. Hinckley, master mechanic on the St. Joseph & Grand Island, has been appointed assistant master mechanic on the Denver & Rio Grande, vice Mr. E. Punchon, resigned, headquarters at Pueblo, Col.

Mr. J. A. Edison, formerly connected with the Kansas City Southern, has been appointed manager of the Denver & Rio Grande system, vice Mr. J. M. Herbert, who has gone to the Colorado Southern in a similar position.

Mr. F. McArdle, formerly traveling engineer on the Burlington, Cedar Rapids & Northern, has been appointed trainmaster on the Cedar Rapids division of the Chicago, Rock Island & Pacific, with headquarters at Cedar Rapids.

Mr. H. J. Simmons, formerly chief engineer of the El Paso & Southwestern, has been appointed superintendent and traffic manager of the same road, with headquarters at El Paso, Texas, vice Mr. W. J. Choate, resigned.

Mr. J. T. Wallace, heretofore assistant engineer of motive power on the Pennsylvania Railroad, has been appointed master mechanic on the Northern Central, with headquarters at Baltimore, Md., vice Mr. J. Milliken, promoted.

Mr. John McGarvey, formerly assistant master mechanic on the West Shore Railroad at Buffalo, has been appointed assistant superintendent of the Brooks works of the American Locomotive Company, which are situated at Dunkirk, N. Y.

Mr. Wm. Kelly, formerly master mechanic on the Great Northern at Washington, has been appointed general master mechanic of the Western Division of the same road, with headquarters at Spokane, Wash., vice Mr. Emerson, promoted.

Mr. Robert P. Schilling, who has been master mechanic of the Lackawanna shops at Utica, N. Y., has been appointed master car builder of the Syracuse, Oswego and Utica divisions of the road. Mr. L. T. Canfield, M.C.B. for the whole road, has just resigned.

Mr. A. F. Hockenbeamer has been appointed assistant to the general superintendent of motive power of the Baltimore & Ohio, having supervision, under the direction of the general superintendent of motive power, of accounts of the motive power department.

Mr. William Reed, at one time assistant superintendent of the Rogers Locomotive Works, who entered the service of the American Locomotive Company in a similar capacity, has recently been promoted to the position of superintendent of the Brooks plant at Dunkirk, N. Y.

Mr. D. C. Dickert, road foreman of engines for the second, third and Chattanooga divisions of the Central of Georgia, has been appointed trainmaster on the same road for the Chattanooga division, with headquarters Cedartown, Ga., vice Mr. J. C. O'Dell, transferred to Macon, Ga.

Mr. W. H. Dunlop has been appointed general foreman of the Atlanta, Ga., shops of the Southern Railway, vice Mr. O. H. Attridge, resigned. Mr. Dunlop was general engine house foreman for a number of years, and his many friends wish him every success in his new field of service.

The following appointments were recently made on the Gulf, Colorado & Santa Fé; Mr. F. Merritt to be resident engineer of the northern division, with headquarters at Cleburne, Tex.; Mr. J. C. Christy, resident engineer of the southern division, with headquarters at Temple, Tex., and Mr. M. F. Temple, resident engineer of the Beaumont division, with headquarters at Beaumont, Tex.

William Perkins Tyler, president of the Tyler Tube & Pipe Company, died last month. Mr. Tyler founded the business of this company in 1890, and has devoted the last twelve years of his life to its development, winning not only the respect and regard of his business associates, but the friendship of the many employees of the company. Mr. Tyler's interest in the business will remain undisturbed, and his associates, who have had the benefit of an intimate knowledge of his methods and purposes, will continue the business on the same lines as heretofore.

We believe in readers—perhaps that seems commonplace when stated in the columns of a technical journal—but let us explain. We believe people should read our paper, but we believe they should also read books for pleasure and to gain information. It is often quite possible to combine these. We give elsewhere a list of technical books which we recommend, but we may add that it gives us pleasure to fill an order for any book on the market. If you want a book of any kind write to us direct and we will get it and send it to you. Do not imagine that we refer only to technical books or those of an educational character. If you want any book on the market and ask us for it you will receive the book. We supply books as cheaply as any one else. If you only want information concerning books write to us and we will be happy to give it to you, gratis.

The Bullock Electric Manufacturing Company, of Cincinnati, have a very pleasing way of keeping their company name before their friends and the public generally. They have issued a very neat illuminated card with the calendar for January, 1903, printed upon it and a small colored portrait of James Prescott Joule. This famous physicist was the one who first established the mechanical equivalent of heat. He found it to be 772 foot pounds, though more recent experiments have raised the figure to 778. He also established the temperature of water when at its maximum density, 39.2 degrees F.

President Cassatt, of the Pennsylvania, has offered to take any locomotives that locomotive works of the country can build if any road having orders for 1903 will turn its contract over to the Pennsylvania, and President Loree, of the Baltimore & Ohio, is quoted as saying that no man can get a locomotive until January, 1904, unless the orders are now in, and that money will not buy them previous to that date.

Ten-Wheel Passenger for the Southern Railway.

The Southern Railway Company have recently bought some simple passenger engines from the Baldwin works in Philadelphia. The cylinders are 21x28 in. and the driving wheels measure 72 in. in diameter. The total weight of the engine is 170,920 pounds, of which 128,670 rest upon the drivers. With steam pressure 200 pounds, the calculated tractive effort is about 29,000 pounds and the ratio of adhesive weight to tractive power is 4.4. The engine is a substantial machine, and the general effect of the whole design is pleasing. The connecting and side rods are of the fluted type and the cross head is secured to the piston-rod by collar and nut. The valves are the usual D-slide balanced. The eccentrics are, of course, on the main driver and the link is placed some distance in front of the rocker, with transmission bar carried back to lower rocker pin, giving indirect motion. In this engine the driving wedges are in front of the axles, and the pedestal binder consists of a bolt and filler.

The heating surface in the firebox is 136.33 sq. ft., while the tubes add 2,533.07 sq. ft., making a total of 2,669.4. The grate area is 44 sq ft. The engine truck wheels are 36 in. in diameter and are spoked. The cab is roomy, well lighted where the engineer sits, but it has a blind panel in the forward part, as may be seen in our illustration.

A few of the principal dimensions are as follows:

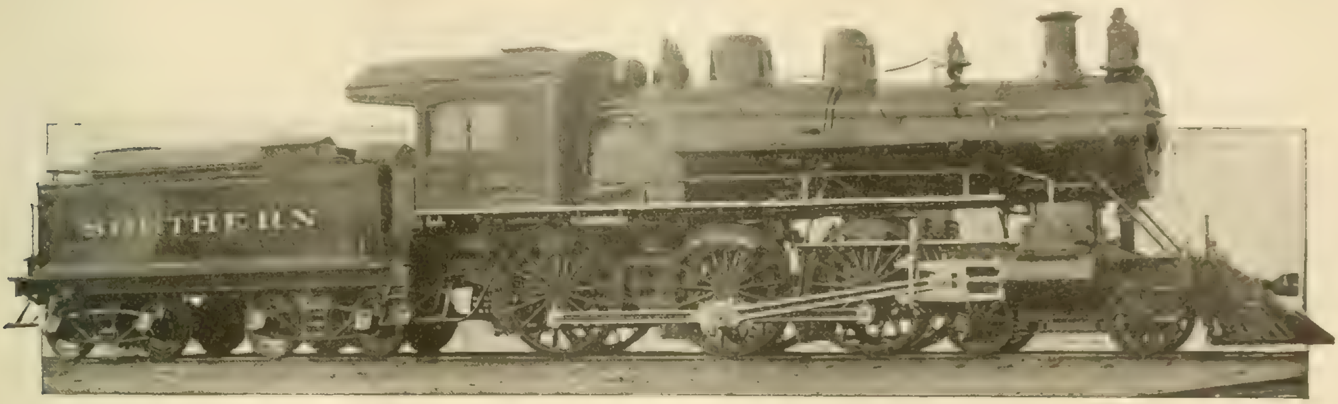
Gauge, 4 ft. 9 in. Cylinder, 21x28 in.

BOILER.

Type, wagon top. Dia., 64 in.
Thickness of sheets, $\frac{17}{32}$, $\frac{19}{32}$, $\frac{5}{8}$ in. Fuel, bit. coal.
Firebox, length, 96 in.; width, 66 in.; front, $68\frac{7}{8}$ in.; back, $45\frac{7}{8}$ in.
Thickness of sheets, sides, $\frac{3}{8}$ in.; back, $\frac{3}{8}$ in.; crown, $\frac{3}{8}$ in.; tube, $\frac{1}{2}$ in.
Tubes, number, 328; dia., 2 in.; length, 14 ft. 9 in.
Driv. jour., 9x12 in.; engine truck jour., $5\frac{1}{2}$x10 in.
Wheel base, rigid, 15 ft.

Weight on driving wheels	128,670 lbs.
On truck, front	42,250 lbs.
Total	170,920 lbs.

Tank, capacity, 5,000 gals.
Tender, wheels, dia., 38 in.; journals, 5x9 in.



SOUTHERN TEN-WHEEL EXPRESS ENGINE.

New Safety Device for Railways.

The United States Consul-General at Berlin, Mr. F. H. Mason, has recently given some interesting data regarding a new safety device for use on railways for preventing collisions. It was tested with entire success in presence of experts on one of the State lines near Frankfort. The description and operation of this appliance may be summarized somewhat as follows. Midway between the rails is laid an electric conductor in the form of what is usually called a "third rail." Under the engine is hung an electrical apparatus, enclosed in a square case occupying about a cubic foot of space, and this instrument is connected to the third rail by a contact shoe. Telephone wires and the wires of a red incandescent lamp run from the case under the engine to the cab. When the third rail becomes charged, in the sending of a warning signal to the moving train, the impulse which rings the alarm bell in the cab also lights the red lamp. A further improvement, we are told, sets the electric brakes on engine and train at the same time that the bell rings and the lamp glows. The apparatus is so arranged that the man on the engine can at any moment, by touching a lever, satisfy himself that it is in efficient working order.

The tests were made with two locomotives equipped with the device. The experiments are described as follows:

"Engine 290, drawing a special train and approaching Sachsenhausen at full speed, received the danger signal and came to a full stop; the driver of 290 then asked by telephone the cause of the signal and received from the keeper of a grade crossing, half a mile in front, word that a wagon had broken down in crossing the track and obstructed the line. After ten minutes' wait, the engineer of 290 received word by telephone that the obstruction had been cleared away and thereupon resumed his trip. A mile further on, the signal on 290 again sounded, and the driver was informed, by telephone as before, that the semaphore round a curve and more than half a mile distant was set at "halt." Thereupon engine 290 slowed down and proceeded cautiously, sounding its whistle at short intervals, the telephone bell in the drivers' cab ringing continuously until the curve was rounded, when the ringing ceased, notifying the engineer that the semaphore had changed to 'track clear.' Thereupon 290 resumed full speed.

"In the tests to prevent collision, engine 1420 came up rapidly from behind and on the same track as 290, which had slowed down and was proceeding cautiously in consequence of reported danger in front. The moment that 1420 came within 1,000 meters (1,093 yards) of 290, the signal on both engines began to ring and their red lights to glow. Thereupon 1420 halted, the driver inquired of 290 in front the cause of the alarm, and a complete understanding between the two trains was immediately established."

In practice, the warning signal is seen and heard on every engine equipped with the apparatus which is on the same track and within the prescribed limits. If a train runs past a semaphore falsely set at safety, and thus enters a block where an engine has halted or is moving along, warning will be given in ample time to prevent collision. Conditions of darkness, storm, fog or mistaken instructions do not invalidate the certainty of the signal. In fact, this invention of Messrs. Hubert Pfirmann and Max Wendorf puts the engineer of every train into instantaneous touch with other trains, switchmen and station and crossing keepers who are within the prescribed limit arranged for the apparatus. An automatic visual and audible signal is thus made to become active the moment the locomotive which carries it, while running either forward or backward, is even menaced with the danger of collision. The device as it stands, as Mr. Mason points out, may not be as perfect as daily operating conditions may be found to demand, but in the judgment of those whose opinions are entitled to respect, the way to safety has been clearly pointed out.

Byegones shall be byegones, and a new page turned for you to write your lives in.—*Bleak House.*

An Efficient Boiler Shop Tool, for Fitting Crown Stays.

A very efficient home-made tool is to be found in the boiler shop of the Rogers Locomotive Works at Paterson, N. J. It is a tapping and reaming machine, designed by Mr. Ruben Wells, general manager of the works. The machine consists of two structural steel channels which stand out horizontally from one of the posts of the shop, perhaps 15 ft. from the floor. On the upper edge of these channels are placed four movable spindles, with belt-driven pulleys on each end. These pulleys are loose on their shafts, and the ones, over, say the right channel, revolve in one direction, while those over the other channel rotate in the opposite direction. A friction clutch capable of being moved to the right or the left imparts to its sleeve, when engaged with either pulley, the motion of the pulley it bears against. Connecting with each horizontal shaft is a vertical spindle, which on its lower end has two universal joints and a socket which holds tap or reamer facing tool or stay-bolt head. A pair of bevel gears communicate the motion of the clutch-sleeve to the vertical spindle in each case, so that stays may be screwed in or backed out as desired. The vertical spindles are arranged with counterweights bearing against collars so that the weight of the spindle with joints and tool are just very slightly more than balanced, and, therefore, rise up out of the way when not in use. For reaming and facing for button heads a positive feed is used. A hanging handle enables the workman to draw down the spindle and enter tap or reamer or stay as he may wish. The spindles have a vertical movement of about 42 ins.

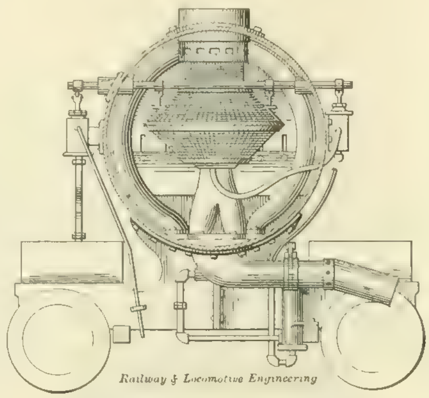
The method of operation is for the large shop crane to place a boiler bottom upward on a low truck beneath this machine, the holes in crown sheet can then all be reamed or tapped or stays screwed in without any further movement, the four spindles of this tool doing the work of more than twice that number of men. Each workman with helper has two spindles to manage and has a hanging handle with which to lower it while the counterweight carries it up when the pressure of his hand is withdrawn. When free of the feed as when tapping, the spindles follow the travel of the tap without any dragging forces to interfere. A lever which operates the friction clutch secures a right or left-hand rotation to the spindle, and the middle position of the lever stops its motion at once. The series of pulleys which cause the reverse or "backing out" rotation, are run at a more rapid rate than the others, so that tools or work can be run back and out very quickly. In screwing in button-head crown stays, through crown and roof sheet, this machine is used to run down the stay until the head all but touches the crown sheet, the final drawing up (about one round) is done by hand so that no injury to the thread on bolt or crown-sheet can take place by screwing the head too tight against the sheet.

In the boiler shop this tool is regarded with high favor, as an easy, rapid, accurate, effective and cheap way of doing this otherwise slow work on firebox crown-sheet staying.

Spark Arrester for Wood and Coal Burning Locomotives.

In connection with this spark arrester, designed by Mr. E. J. Smith, Master Mechanic of the Plant System at High Springs, Fla., writes:

I herewith hand you a sketch of a spark arrester and spark ejector, and beg to say that I have got this spark arrester in about fifteen engines on the 5th district of the A. C. L. Ry. running out of High Springs and Palatka, Fla. The device is a



SMITH'S SPARK ARRESTER.

perfect success on both wood and coal-burning engines, and much more economical with fuel than the present standard coal-burning spark arrester or the balloon stack, which is in universal use throughout the country.

This spark arrester is on some of our engines in the heaviest service that we have; for instance, we have three engines with this arrangement in them running from Palatka to St. Petersburg on a 220-mile run, burning wood. Last winter we had these engines burning coal with this arrangement in the front end and have made an average of 40 miles to a ton of coal, during the busiest months in the winter season, on the heaviest local passenger trains handling from seven to nine coaches and express cars. We also have a few of our passenger engines fitted up on trains 39 and 40 from High Springs to Lakeland. These are 16-inch engines, handling from five to ten cars and burning three cords of wood to 140 miles.

I thought that you were on the lookout for anything new to publish, and beg to say that this device has been in use now about 18 months, giving entire satisfaction to the management. I will state further that I am putting all the parts on these engines here with the exception of the cylinder on the left-hand side, which works from the blower when the blower is applied, and beg to say that the sparking device for cleaning the smoke box works nicely, and the engine can be sparked while rolling along, shut off.

Fast Railroading.

They had been speaking of fast runs on railroads. "That reminds me of a run we made some time ago on a train which came in from a point on the coast," said the man who wanted to add zest to the conversation, "and it was about the fleetest trip I ever had on a railroad.

"The train was behind time about an hour, and I think the engineer made an effort to catch up between the city and a point not so very far out on the coast. At any rate, it looked very much like it to me. We shot through the air like an arrow. Sometimes it would seem to me that we had left the track altogether. That clicking peculiar to railroad trains could not be heard. About all we could hear at times would be the whizzing of the wind as it split by the windows. Across bayous and through marshes we rushed like mad. When we reached the Rigolets the most remarkable thing I ever saw took place. The train was traveling so fast it sucked the water up behind it as it rushed across the trestle, and I could hear the fishes groan as we flew over this neck of the gulf. Most remarkable thing I ever saw in the way of fast runs." And he lapsed into silence.

"I'm glad you reminded me of that run," said another member of the group. "I had forgotten the incident. I can vouch for all you say, for I was on the back end of the last coach, and the water which was sucked in behind the train by the vacuum almost washed me overboard, but I held on all right, and when we had made the crossing and the waters had receded I picked up on the platform of the rear coach the finest bunch of fish I ever saw. They were no doubt the fish you heard groaning."—*New Orleans Times-Democrat.*

"Firstlings of the Flock."

The first locomotive to run on rails was built in Wales by Richard Trevithick in 1803. First locomotive built by Stephenson was the "Blucher," 1816. First cars with outside bearings and coned wheels were built by Ross Winans for the Baltimore & Ohio R. R., 1829. First locomotive to run on rails in America was Peter Cooper's "Tom Thumb," which was tried on the Baltimore & Ohio R. R., 1830. First locomotive with six coupled wheels was the "Middlesborough," by Timothy Hackworth—English, 1830. First Amer-

ican time-table was published by the Baltimore & Ohio R. R. in the *Baltimore American* in 1830. First set of rules for employees, was issued by the same road in 1830. First locomotive with a bogie truck was the "Experiment," designed by Jervis, and built by the West Point Foundry, 1831. First steel springs under a locomotive were used on the "York" in 1831. First issue of RAILWAY AND LOCOMOTIVE ENGINEERING (then called *The Locomotive Engineer*), was in January, 1888.

Consolidation for the Baltimore & Ohio Railroad.

This 2-8-0 type for the B. & O., built at the Schenectady shops of the American Locomotive Company, is a simple engine with 21 x 30-in. cylinders, 57-in. driving wheels and a boiler measuring 72 in. at the outside ring. The working pressure is 190 pounds, and with 162,000 pounds on the drivers, the engine can exert a tractive effort of 37,000 pounds, making the ratio of tractive force to adhesive weight 4.3. The total weight of the engine in working order is 186,000 pounds. All the wheels are flanged, but lateral play has been allowed for by varying the distance between tires. The forward and rear pairs of drivers are 53 1-8 in. between tires, while the second and main drivers measure 53 1-4 between tires.

This design shows advanced thought in locomotive construction, as may be seen by the liberal grate area—which is 50.32 sq. ft., and the ample heating surface, which amounts to a total of 3,495.82 sq. ft. Cast steel has been used for the deck, grate-bar bearers, frame braces and other details, which have heretofore usually been cast and wrought iron.

The valves are of the piston type driven by direct-acting gear, and the transmission rod rises over the second driving axle with very little curve. The first and second drivers are equalized with springs over the boxes, while the main driver and the trailer are separately equalized together, with spiral springs before and after, and a semi-eliptic spring acting as equalizer between them.

The tender frame is made of steel channels, and the trucks are of the Fox pressed steel type.

Some of the more important dimensions are appended for reference:

GENERAL DIMENSIONS

Fuel, bituminous coal.
Weight in working order, 186,000 lbs
Weight on drivers 162,000 lbs

VALVES

Greatest travel, $5\frac{1}{2}$ in., outside lap, $\frac{7}{8}$ in.; inside lap, line and line; lead in full gear, $\frac{3}{32}$ in.

WHEELS, ETC.

Dia. and length of driving journa's, $9\frac{1}{2}$ & 9 x 12 in.
Dia. and length of crank pin journals, main, $6\frac{1}{2}$ x 6 in.; main side, $7\frac{1}{2}$ x $5\frac{1}{4}$ in.
Dia. and length of side rod crank pin journals, inter., $5\frac{1}{2}$ x $4\frac{3}{4}$ in ; F. & B., 5 x $3\frac{3}{4}$ in.

BOILER.

Style, straight, wide fire box.
Thickness of plates in barrel and outside of fire box, $\frac{1}{2}$, $\frac{13}{16}$, $\frac{5}{8}$, $\frac{25}{32}$, 1 in.
Fire box, length, $91\frac{1}{8}$ in., width, $75\frac{3}{8}$ in., depth, 73 in. F, 63 in. B.
Fire box plates, thickness, sides, $\frac{5}{16}$ in.; back, $\frac{3}{8}$ in.; crown, $\frac{3}{8}$ in.; tube sheet, $\frac{1}{2}$ in.
Tubes, number of, 396; dia., 2 in.; length over tube sheets, 16 ft.
Fire brick, supported on water tubes.
Heating sur., tubes, 3298.08 sq. ft ; water tubes, 22.34 sq. ft.; fire box, 155.40 sq. ft.; total, 3475.82 sq. ft.

TENDER.

Weight, empty, 44,300 lbs ; wheel base, 18 ft. 9 in.
Tender frame, 10 in steel channels.
Water capacity, 5,900. U. S. gals.; coal, 10 tons.
Total wheel base of engine and tender, 57 ft. 4 in.

LATEST B. & O. CONSOLIDATION ENGINE

Outrages Committed on Trainmen in Mexico.

There is no doubt that railway trainmen are outrageously treated in Mexico when any charge can be schemed against them by representatives of law and justice. When any particularly flagrant piece of tyranny is inflicted upon an American the labor organizations appeal to the American Minister. He pretends to investigate, but that is done in a half-hearted way, as the Minister's sympathies are all on the Mexican side, and the report is made that no cause for complaint exists. The iniquity is covered up and some miserable American who has committed no offence is permitted to languish in a filthy Mexican jail and everything is lovely with the United States representative until another outrage happen .

A meeting of representative railroad men, through their brotherhoods, was recently held in Kansas City, Mo., to protest against recent outrages upon trainmen in Mexico. The present agitation was started by Harry H. Adams, formerly a locomotive engineer in Mexico. While he was employed on the Vensges, Central & Matuhsullu Railway, on May 21, 1901, Adams says his engine and seven cars were wrecked, he being absolutely without fault in causing the wreck. His left leg was crushed and later had to be amputated. Adams says that even before he received medical attention he was taken before a Magistrate, was fined and then thrown into prison, where he remained a month.

Other Americans are in Mexican prisons, he says, whose trains were in wrecks through no fault of the prisoners, and some of them have been in prison seven or eight years. Adams, while in prison, met some of these men, who begged him to appeal to the railroad men in America to interest themselves in their cases.

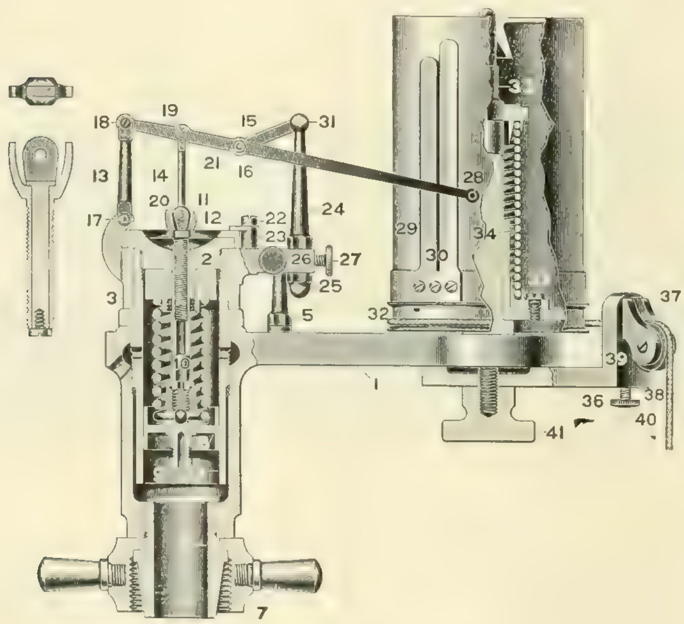
After two years' experimentation with nickeled rails the Pennsylvania Railroad has decided to place them on the heavy curves through the Allegheny Mountains. An order for 5,000 tons has been given at a cost of $370,000. The nickeled steel rails cost nearly three times as much as rails of standard steel. The tests made by the Pennsylvania Railroad have shown the durability of the nickeled rails to be more than three times that of standard steel.

The Louisiana Railroad Commission has a rule that railroads must furnish cars within ten days from the time they are ordered. It is a very easy matter for railroad commissioners to say that cars must be supplied, but "must" does not bring into existence cars that have yet to be built. It is a pity that Railroad Commissioners seldom know anything about railroad business.

The Star Improved Indicator.

One of the improvements introduced in the construction of the steam engine indicator, made by the Starr Brass Manufacturing Company consists in the attachment of the cap 2 at the top of the cylinder to the interior shell within which the piston moves. This "interior" arrangement secures correct alignment for the motion of piston and rod. The interior shell being removable, for repairs, etc., is so placed when in service, as to provide a jacket space for live steam, thus maintaining uniform temperature and securing perfectly equal expansion. A noticeable feature is the means for unscrewing and removing from the cylinder the cap with parts attached. The cap has a milled edge made of hard rubber which is a non-conductor of heat, and this allows the operator to mechanism from the cylinder. A new form of detent is also used. This is in the form of a friction clutch. It consists simply of a ball which is thrown into hard contact with a groove of unequal radius, cut in the base of the drum. Electric operating mechanism can be used if desired. The indicator is a good specimen of accurate workmanship, the thickness of the arm has been increased, to reduce vibration, and the instrument is at once strong and as light as it can be made.

Improvements of the kind outlined above help to increase the use of indicators by removing some of the troubles and discomforts incident to work with the high pressures of to-day. The best and most convenient indicator is none too good for the difficult and exacting task of taking locomotive dia-



STAR IMPROVED INDICATOR.

handle it with comfort. Another arrangement for comfort which will be appreciated is that the indicator is vented on the side less likely to be encountered by the hand of the user when turning on the indicator cock. A suitable attachment with hose can be clamped to the barrel, and this arrangement will effectually carry the scalding drops a sufficient distance below the body of the instrument. "Once burned, twice shy," seems to have been the motto of the designer of the improvements to lessen the danger from heated cap or hot water and steam, and never had motto better application.

The piston rod of the Star Improved Indicator is provided with an adjustable swivel nut, so planned that the atmospheric line can be drawn at any desired distance from the bottom of the card, without removing the piston and its grams. A scientific instrument of precision which entails burned fingers or a scalded wrist, is often not as popular with frail humanity as the good work it can be made to do, fully entitles it to be. Indicator improvements along these lines are welcome.

Stay-Bolts at the Rogers Works.

Stay-bolt threading is done very rapidly and cheaply at the Rogers Locomotive Works in Paterson, N. J. Solid dies are used entirely and none of the bolts are cut in a regular lathe. Short side-sheet stay-bolts are threaded their entire length in a machine of ordinary form, having eight upright spindles, which cut good, clean screw-threads. The threading of the long, crown-sheet stay-bolts, with or without button-heads, is another matter. These bolts are made, speaking generally, in two sizes, each has a larger diameter where it is screwed into the crown-sheet than it has in the roof-sheet. A bolt 1 in. in diameter in the roof-sheet will be 1 5-32 in. in the crown-sheet and a bolt 1 1-8 in. in the roof is 1 9-32 in. in the crown. This arrangement permits the bolt being dropped in so that the threads engage in the roof-sheet only a few turns earlier than in the crown, and this saves time.

In the matter of threading, the first operation is to true up the two ends of the stay-bolt, which are of unequal diameter, and face the under side of the button-head, where there is one, and leave the central portion of the stay untouched. The work of cutting the screw threads is done on an old-fashioned machine which has defied the scrap heap for many years. The man in charge, not being a very high-priced operative, threads first one end and then the other, with the most perfect indifference as to whether the thread at one end coincides with the thread at the other. In fact, no effort is made to get them to come right, and they are sent over to the boiler shop in this condition.

It is in the boiler shop, however, that this apparently inaccurate work ceases, and by a simple and rapid process all error concerning the thread is eliminated. As the pitch usually employed is 12 threads to the inch, the maximum error could only be half a thread or 1-24 of an inch. The method of bringing the upper and lower screws into exact unison, so that the regular advance of the thread shall be the same as if the entire length of the stay-bolt had been threaded in a lathe, is done by simply lengthening the bolt the required amount. On a handy shelf there lies a "master" bolt. It has been carefully threaded in a lathe for its entire length and hardened to reduce wear. Each stay-bolt is placed beside it, and the threads made to engage at the upper end. If they also engage at the lower end the stay-bolt is "passed." If the lower end shows want of coincidence it is put under a small spring hammer, with semicircular dies, which is operated by a treadle and friction clutch. A blow or two from this hammer, struck in the unthreaded center of the stay-bolt lengthens it so that the threads at both ends exactly match the continuous thread of the master bolt and the now corrected stay-bolt is "passed" for use in the boiler. The whole method is inexpensive, accurate and easy, and not a single complaint has been received concerning such "rectified" stay-bolts.

American School of Correspondence.

We have received the catalogue of the American School of Correspondence which is at the Armour Institute of Technology in Chicago. We may be permitted to quote an apt saying in one of the opening paragraphs in the cata-

logue: "Intelligent people to-day believe in the common-sense plan of spending a portion of their spare time in self-improvement, for they know that by so doing they can greatly increase the value and pleasure of life. If a man does not study and advance, but remains stationary and in a rut, excluded from the new and fresh interests of the world, he gradually grows to be a mere machine which is soon thrown out for a new and up-to-date type." The correspondence courses which are divided under the heads of electrical engineering, mechanical engineering, steam engineering, drawing, mathematics, civil engineering, architecture, sanitary engineering and textile manufacture, are all designed to be thoroughly practical, and to extend at small cost a valuable technical education to the great wage-earning class everywhere. There are no entrance examination required, nor is there any age limit. In each of these departments there are two or three regular courses with about twice as many special courses. The correspondence method as here carried on aims to be a technical school for wage earners who are limited in means.

The Armour Institute of Technology was founded by the late Philip D. Armour, of Chicago. Recent changes and extensions of equipment, faculty and scope of work has enabled the institute and correspondence school to greatly widen its sphere of usefulness. The old adage is perhaps especially true of an establishment of this kind, which says: "Speaking makes a ready man, reading makes a full man, and writing makes an exact man." The two last very desirable qualities, at least, may be had through the correspondence method of getting knowledge. The catalogue contains a list of graduates alphabetically arranged according to states, and among the foreign countries are the names of graduates from Canada, Mexico, Holland and New Zealand.

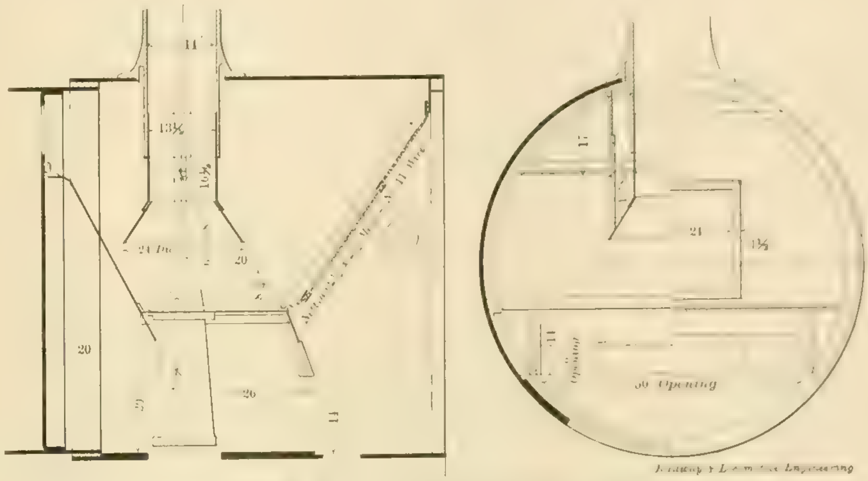
The Original Inventor of the Pilot.

There is living at Alto Pass., Ill., the man who claims to have invented the present form of locomotive pilot, or "cow catcher," as the country people call it. This man's name is Eastman, and he helped to build the first railroad in Ohio, which was known as the Mad River and Erie Railroad, now a part of the Big Four system.

The first locomotives on that road were fitted with "cow catchers," consisting of two long curved iron rods that picked up a cow or other large object and carried it along. The first improvement on the "cow catcher" was the "cow bumper," which resembled the pilot now in use, but it proved unsatisfactory, and one day while Mr. Eastman was at work in the shops at Sandusky an engineer entered and told the master mechanic that unless an improvement over the "cow bumper" could be had he would resign.

"Something is needed that will throw an object to one side," said the engineer. The master mechanic turned to Eastman and asked him if he could make something that would answer the purpose. Eastman replied in the affirmative, went to work and the locomotive pilot practically as it is now was given to the world.

Mr. Eastman received no remuneration other than his regular wages for his invention of the pilot. He wears a small silver model of an engine pilot as a watch charm. Mr. Eastman settled in Union County forty-six years ago on a farm near Anna, where he still resides. He was born in New York State and comes from one of the oldest eastern families. He has seven children, thirty grandchildren and six great-grandchildren.



C. & E. I. STANDARD FRONT END

C. & E. I. Standard Front End.

The accompanying illustration is furnished through the courtesy of Mr. T. A. Lawes, Supt. M. P., of the C. & E. I. A glance at it will show its good qualities, and the point all railways are aiming at, that of having free steamers.

The lift pipe is so arranged that it can be raised or lowered to suit conditions.

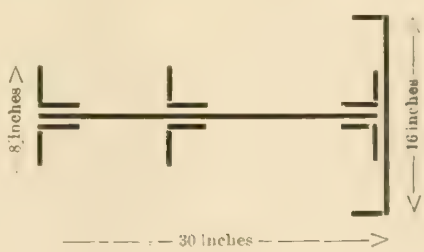
There is no accumulation of cinders on top of the plate, to enter the nozzle when engine is drifting and the front end is always free from them.

The engine throws no fire, and the company in the past year has not been called upon to pay a single case of damage by fire from this source.

Hand plates and spark hoppers are entirely dispensed with, showing a saving in this direction also.

Improvements in the Rogers Locomotive Works.

The Rogers Locomotive Works, at Paterson, N. J., has been undergoing extensive improvements for some time. The new erecting shop was occupied but a short time ago. This is a thoroughly modern building 264 ft. long by about 100 ft. wide, with a clear height of 50 ft. This shop is served by two Niles cranes. One of 100 ton capacity and one of 25 tons, with heights respectively, under hook, of 38 and 25 ft. There are sixteen pits which run at right angles to the length of the shop, and there is one additional track for scales, etc. The pits are supplied with exhaust steam heat, live steam, compressed air, gas and water. The space back of the pits having an average width of 28 ft. is variously apportioned. The far end of the shop is devoted to pipe cutting and pipe bending. In the far corner is placed some blacksmiths' forges. The rest of the space is occupied by small tools, with areas partitioned off for tool room and supplies and for bolt storage. The line of shafting attached to the columns in the erecting shop and all tools are driven by water power. The steel columns are of the section shown, and were so made for the sake of lightness, while securing the requisite strength.



The entire surface of each can be readily coated with paint. The shape is also very convenient for making attachments to. The shop is well lighted, both by daylight and artificial means, it is thoroughly drained and is a bright comfortable healthy shop to work in.

The opening of this new shop relieves some of the pressure on space

which had existed. The old erecting shop is now used for boring planing and fitting up cylinders, and the space heretofore reserved for this kind of work is now otherwise employed. The modernizing of the works has considerably increased its capacity. The boiler shop was remodelled some time ago, and the various improvements are steadily being made without interference of the output of the plant. The Rogers works report a full order book for some time to come.

Northern Co.'s Metallic Packing.

The metallic packing made by the Northern Manufacturing Company, of St. Paul, Minn., is said to have given excellent results on some of the leading northwestern railroads. The packing is made by modern methods and the mechanism used, works very exactly, thereby insuring a perfect ring. The mixture of metals in the ring is something comparatively new, and several years' use on a leading road in the northwest has demonstrated it to be most satisfactory for the purpose required. In this packing the telescoping of number one ring is impossible until worn out, and this enhances the wearing capacity of the packing.

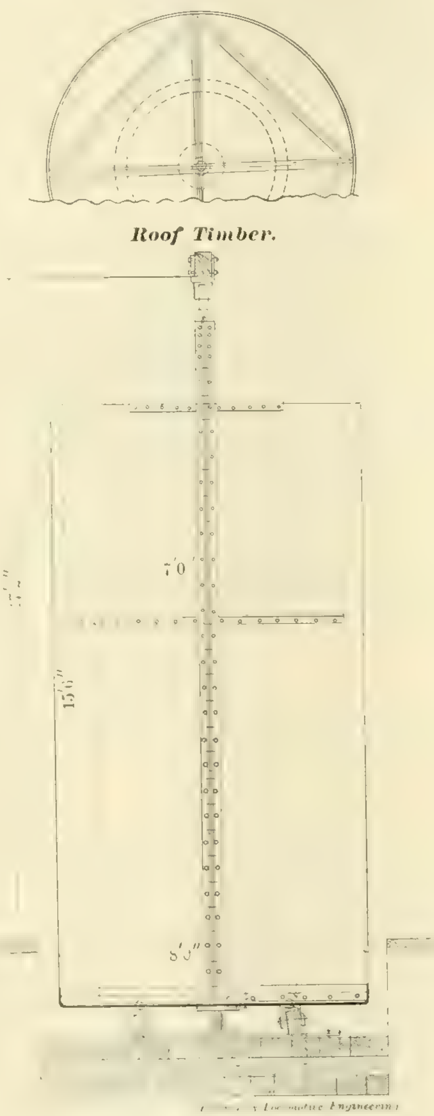
The rings in this style of packing are jointed together with a sharp V-shaped projection, the straight faces not coming together until pressure is brought to bear on them by the follower ring and spring; this makes a perfectly steam-tight joint, and any one with a mechanical turn of mind will appreciate the action of the V's in the cone when under pressure.

These rings, we are told, have not been turned in a lathe, though the perfect fit of the joints suggests that mode of finishing. We understand that the Northern Mfg. Co. will be pleased to send particulars to any railway official who is interested enough to apply to them for it.

A number of railroad companies are already placing orders for locomotives to be delivered in 1904, and in a number of instances it is stated the roads, in order to secure power, are paying as high a premium as $1,000 per locomotive. The premium is not paid to the locomotive builders, but to other railroads which have secured space with the builders. Roads finding that they will not require for some time all the locomotives ordered, or for which space has been reserved, are disposing of a portion of their orders to other roads at a premium. This is made necessary by the heavy demand for motive power and the fact that the locomotive works have orders on hands that will tax their fullest capacity for 1903. This is an exceedingly profitable method of selling "space."

A Revolving "Book-Case" for Tubes.

A rack for holding locomotive flues, constructed on the revolving book-case principle may be seen in the shops of the C. & E. I. Railroad at Danville, Ill. It consists of a circular table made out of 1-4-inch plate, 8 feet in diameter, which is pivoted in the center with a male and female casting. The pivot point, however, does not carry any weight; the load rests on four coned wheels, which run on a circular track made of flat iron. From the circular table rise four plates which in plan are



REVOLVING FLUE RACK, C. & E. I.

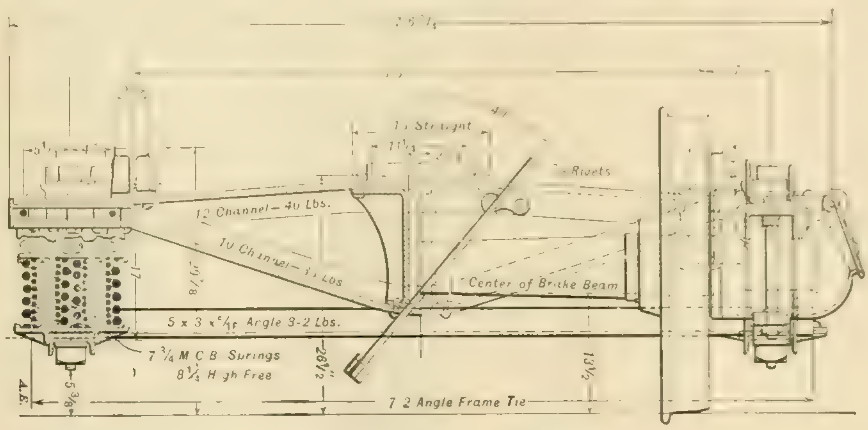
arranged in the form of a cross, so that the revolving rack has four spaces in which to carry tubes. The angle irons joining the upright plates in the center are carried up and terminate in a pivot casting which has its bearing in the roof timber. Angle irons riveted to the plates about 10 feet up help to stiffen the rack, while the top is reinforced by a 1-4-inch circular plate. The whole arrangement is very simple and inexpensive. It has the advantage of economiz-

ing space very effectively in the boiler shop. The tubes after being welded are placed in an upright position in one of the divisions of the rack, the angle made by the two upright sheets tends to keep the tubes together at the top if the lower ends are somewhat spread over the bottom of the rack. When a number of tubes have been welded the whole rack is turned and an empty space is brought round for the flue-welder to fill, while the man who tests and cuts the tubes to proper length, has in front of him the tubes on which he has to work. With this rack, the tubes are easy to handle, take up a minimum of room, and are moved at once from one man to the other as successive operations require.

Steel Channel Arch Bar Truck.

A truck suitable for a 100,000-pound capacity car has lately been designed and patented by Mr. Cornelius Vanderbilt. The truck is made of commercial shapes and has comparatively few parts. The top arch bar is a 5-inch. channel weighing 9 pounds per foot, while the lower bar is of the same section but weighs 11 1-2 pounds per foot. These channels are placed back to back and form the compression and tension members of an ordinary diamond pattern truck. The lower arch bar, however, has its channel formation changed to that of a flat bar, just as it passes up over the axle box. This arrangement has the advantage of giving a wide bearing on top of the box without the necessity of using a filling piece, and at the same time it keeps the height of the top arch bar much the same as it would be in the ordinary form of truck. The flat termination of this second arch bar on top of the box is lipped up against the end of the top bar, thus making the "diamond" form self-sustaining. The familiar truck transoms are, in this design, represented by two 5 x 3 x 5-16-inch angles which fit on top of the lower arch-bar and are united to column castings by rivets, while angle transoms, lower arch-bar and tie-bar are also held together by the column bolts. The tie-bar below the boxes is lipped up on the box so as partly to relieve the axle-box bolts of sheering strain.

The bolster for this truck is made of heavy channels; the upper one, carrying the center plate, and the side bearings is made 12 inches wide and weighs 40 pounds per foot. It is canbered up 1 1-2 inches and is placed with flanges down. The lower member is also a channel, but is 10 inches across the face, 35 pounds per foot, and is placed with flanges up so as to fit inside the upper channel, and the interposition of a cast filler makes the ends perfectly solid when riveted together. Bolted through this filler piece is a casting which forms a guide with the column casting, and as it extends under the bolster ends makes the bearing surface for three eliptical rollers or rather rockers, which, while allowing side swing to the bolster, has a tendency to keep it constantly in the center of the truck. Below the center casting is a filler of cast iron which separates the two channels, a distance of 13 3-8 inches, making a deep and strong trussed structure. The position of the channels, one being inverted and one normal, brings the webs of each into the most advantageous position to deal with the stresses which they were designed to withstand. The king pin of the truck passes through the center plate and upper channel which is in compression. The lower channel is sufficiently below the center casting, as not to require its web, which is in the tension, to be pierced or weakened by an opening for the king pin.



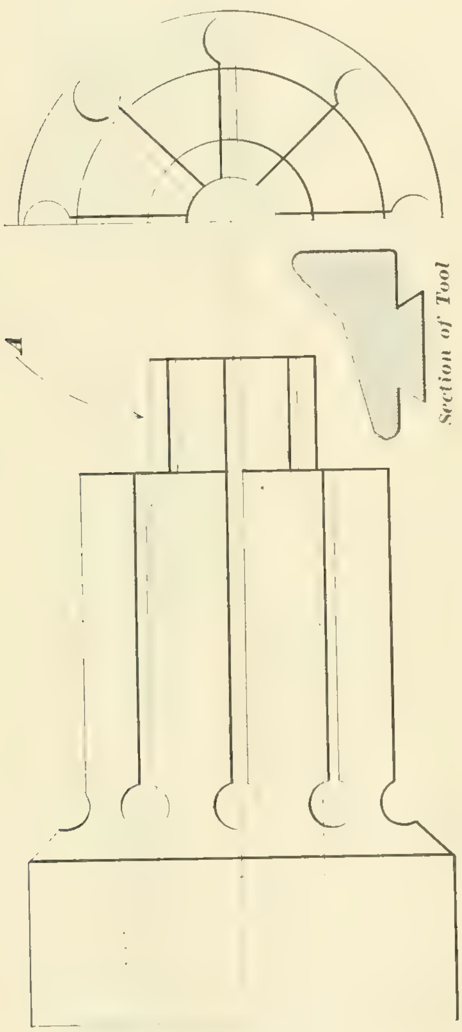
VANDERBILT STEEL TRUCK.

The whole design evinces an endeavor to gain solidity and strength, with a reduction of parts and fixings which will no doubt commend it to car builders and the railway world in general.

Coal is so dear in Honolulu that the people in charge of the railways there are trying to adapt their locomotives to burning liquid fuel.

Expanding Mandrel for Turning U. S. Metallic Packing.

The small machine department at the C. & N. W. Ry. shops at Chicago, which is situated in an upper gallery, where air and light are plentiful, is presided over by Foreman William Wafer. A very expeditious appliance for turning up the rings of U. S. metallic packing, in the shape of an expanding mandrel, has been designed by Mr. Wafer, and is used for doing this class of work. It



EXPANDING MANDREL FOR U. S. METALLIC PACKING.

consists of a hollow steel sleeve, shown in the accompanying sketch, which screws on to the end of the hollow spindle of a turret lathe. The sloping portion of this mandrel has a series of holes in the fillet, into which divisions have been cut extending from the outer end. When screwed on the "nose" of the lathe an appropriately tapered end on the "draw-in attachment" is pushed into this mandrel, and engaging with the inside taper of the mandrel, causes the circumference of the projection marked *A* to slightly increase. On this projection *A*, the three rough rings of the metallic packing are slipped, and on the mandrel being then expanded, they are held firmly while the outside surface is turned off to exactly fit the inside surface of the vibrating cup used with this packing. The tool is of the shape shown, and turns up a full set in one operation, and also insures perfect interchangeability. The packing rings are bored out when required, to suit the particular valve rod upon which they will be used. The time occupied in turning these rings has been reduced to a minimum.

Of Interest to Readers.

Christmas and New Year's have come and gone with all their pleasant greetings and jolly doings. The good old custom of giving presents to friends has been honored in a very substantial way. This latter custom has also its humorous side. A friend of ours got three writing pads which fold up into nearly nothing, or had waterproof backs or air-tight inkwells. Each of his friends said, in effect, when handing over the presents: "That will come in handy when you travel, you know." Our steady, stay-at-home friend, could not look a gift horse in the mouth, so he replied as cheerfully as he could, "Capital, old man; how did you think of it?" and wondered why his friends were so obtuse. He does not expect to travel much this year, certainly not to the extent that three folding pads would indicate, and when he does travel he does not write home. What the polite victim really wanted was a good book or two. Books generally make a very safe present, and they are just as good to the man who travels as to the stay-at-home. Another thing about books is that they are appropriate gifts all the year round, and a man may give one to a friend, or he may, with equal propriety, give one to himself. The chances are, if he gives one to himself, both giver and receiver will be pleased and benefited. Our book department will supply any book on the market, but here is a very good bill of fare of railway, mechanical and engineering works, which we recommend:

A year's subscription to RAILWAY AND LOCOMOTIVE ENGINEERING costs only $2.00, and the paper is a welcome visitor, especially where there are children.

"The World's Railway" is a most interesting history of railways and locomotives. It is beautifully illustrated and the net price used to be $10.00. We now give it and a year's subscription to RAILWAY AND LOCOMOTIVE ENGINEERING for $5.00.

"Locomotive Engine Running and Management," by Sinclair, is an old and

universal favorite. A well-known general manager remarked in a meeting of railroad men lately, "I attribute much of my success in life to the inspiration of that book. It was my pocket companion for years." The price is $2.00.

"Practical Shop Talks." Colvin. A very helpful book combining instruction and amusement. It is a particularly useful book in the hands of a young mechanic. Has a stimulating effect in inducing young men to study their business. Price, 50 cents.

"Examination Questions for Promotion." Thompson. This book is used by many master mechanics and traveling engineers in the examination of firemen for promotion and of engineers likely to be hired. It contains a wonderful amount of information about the locomotive, in small compass. Convenient pocket size. We cordially recommend this book. 75 cents.

POWER HOUSE—BOSTON ELEVATED.

"Compound Locomotives." Colvin. A little study of this book will instruct a man so that he will understand the construction and operation of a compound locomotive as well as he understands a simple engine. Tells all about running, about breakdowns and repairs. Convenient pocket size, bound in leather, $1.00.

"Catechism of the Steam Plant." Hemenway. Contains information that will enable one to take out license to run stationary engine. Tells about boilers, heating surface, horse power, condensers, feed water heaters, air pumps, engines, strength of boilers, testing boiler performances, etc., etc. This is only a partial list. Question and answer style. 128 pages. Pocket size, 50 cents.

"Care and Management of Locomotive Boilers." Raps. A book that ought to be in the hands of every person who is in any way interested in keeping boilers in safe working order. Written by a foreman boilermaker. Also contains several chapters on oil-burning locomotives. 50 cents.

"Locomotive Link Motion." Halsey. Any person who gives a little study to this book ceases to find link motion a puzzle. Explains about valves and valve motion in plain language easily understood. $1.00.

"Machine Shop Arithmetic." Colvin and Cheney. This is a book that no person engaged in mechanical occupations can afford to do without. Enables any workman to figure out all the shop and machine problems which are so puzzling for want of a little knowledge. 25 cents.

"Firing Locomotives." Sinclair. Treats in an easy way the principles of combustion. While treating on the chemistry of heat and combustion is easily understood by every intelligent fireman. 50 cents.

"Air-Brake Catechism." Conger. Nothing better can be found for people trying to learn all about air brakes. Tells the whole story. Cloth, 75 cents. Leather, $1.00.

"Skeevers' Object Lessons." Hill. A collection of the famous object lessons which appeared in this paper several years ago. They are interesting, laughable and best of all are of practical value. $1.00.

"Stories of the Railroad." Hill. Best railroad stories ever written. Those who have not read these stories have missed a great literary treat. $1.50.

"Block and Interlocking Signals." Elliott. Tells what signals are, what they do and how they do it. Comprehensive treatise on the subject. Ought to be studied by all trainmen where block signals are used. $3.00.

RAILWAY AND LOCOMOTIVE ENGINEERING. Bound volumes. $3.00.

Lincoln Power Station of the Boston Elevated Railway.

The Lincoln Station of the Boston Elevated Railway differs in many respects from the various other power stations on the same railway system. It is the most recent addition to Boston's numerous electrical power plants and is located on the lot known for many years as Lincoln Wharf. The chimney, 250 ft. high, is said to be the tallest in the city. The building is divided into two longitudinal sections, the boiler room and all apparatus pertaining thereto being in one section and the engines, generators and condensing system in the other. The engine room is served by a large electric crane of 40 tons capacity. The walls of this room are faced with white enamel brick, adding much to its general appearance and illumination.

The present station contains three units aggregating about 13,500 h.p. While it is now complete in itself, ample ground

has been provided for the extension of the building. The boiler installation consists of eight 648 h.p. and four 490 h.p. Babcock & Wilcox boilers. An equipment of Roney mechanical stokers has been installed by Westinghouse, Church, Kerr & Co.

Coal will be automatically unloaded from vessels and stored in large pockets having a total storage capacity of 8,000 tons. Coal is carried to the boilers by the Hunt coal and ash conveying system which conducts the fuel into overhead conveyors leading to the stokers. The plant is also equipped with Green economizers. Feed water is supplied to the boilers by means of two vertical compound pumps manufactured by the George F. Blake Mfg. Co. A Star vacuum feedwater heater of 8,000 h.p. capacity is placed on the base of the chimney conveniently near the feed pumps. As the smoke flues from the boilers enter the chimney at a point some thirty feet from the boiler room floor, the space in the lower part of stack has been found quite valuable for the location of such auxiliaries as feed-water heaters, receiver of the Holly gravity return system and sundry piping.

The original engine installation consisted of two vertical cross-compound units of 4,500 h.p. each, built by the Providence Engineering Co. The generators and flywheels are carried on the shafts between the high pressure and low pressure sides. The generators are direct current machines, rated at 2,700 k.w. each. A third unit which has just been completed consists of a vertical cross-compound engine of about 4,500 h.p., designed and built by the Westinghouse Machine Co., and installed by Westinghouse, Church, Kerr & Co. The engine, however, differs considerably in design and construction from the two engines first installed. The high pressure cylinder is fitted with poppet valves for use with superheated steam, which is supplied by superheaters built by the Babcock & Wilcox Company.

The steam piping represents all that is modern in this important portion of the plant. Steam is conveyed from both sides of the boiler room by 8-in. mains to a 16-in. drum, from which it is conducted by 12-in. risers to Cochrane receiver separators and thence to the engines. All the live steam drips from steam drums, separators and reheating receivers are carried back to the boilers by the Steam Loop and Holly Gravity Return System.

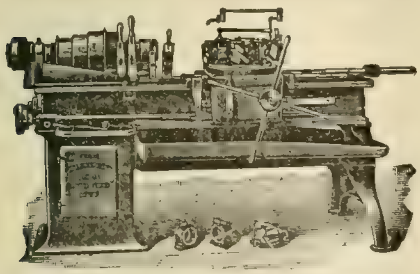
Ingersoll-Sergeant air compressors, each driven by a 50 h.p. Westinghouse, 500-volt motor, supply compressed air for the block signal and switching system used on the road. Early in the conception of the scheme of running trains at high speed under the rather complex conditions here existing, the engineers of the Boston Elevated Railway realized that a block system was necessary, and the Westinghouse electro-pneumatic interlocking system, manufactured by the Union Switch & Signal Co., of Swissvale, Pa., was chosen.

The elevated road includes some 14 miles of track. The switches and signals are controlled from four switch towers and the automatic block signals are located at distances of about 800 ft. apart. Each tower is supplied with indicators showing the approach of trains. The towers at the junctions of the Atlantic circuit and main line control some 1,200 elevated trains daily. The largest tower is located at the Sullivan Square terminal where some 500 elevated trains and 700 surface cars pass in and out daily, involving 6,000 switch and signal movements. A force of only two men on duty is required to operate the switchboard mechanism, consisting of 35 pneumatic levers. The terminals are also supplied with lamp indicators showing the relative location of approaching trains.

OBSERVATION CAR—CANADIAN-PACIFIC RAILWAY.

Passenger Coach with Cupola.

A novel passenger car has been put in service by the Canadian Pacific Railway which is used for the accommodation of passengers when traveling through the Canadian rockies. The car here illustrated is 56 ft. long over all, with observation platforms at each end. The center of the car is arranged as a parlor, with revolving chairs, which seat fourteen passengers. The side windows in this rightly-called observation car are exceptionally large, being about 3 ft. wide by



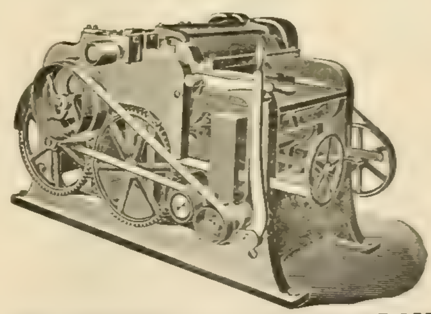
2 ft. 4 1-4 in. high. The upper or fixed portion of the window is composed of four panes of clear glass, which measure, with sash, about 10 in. deep. There is therefore a wide, open and unobstructed view from both sides, for sightseers. At each end of the car there is a platform or dais, raised 4 ft. above the car floor, which is surmounted by a cupola having windows on the four sides and rising about 3 ft. above the roof. The Monitor or clearstory type of roof is, of course, not used here. As each end of the car is exactly like the other, it will be necessary only to describe one. The platform in question is built against one side of the car and has a passage along its outer edge. Its floor is about 8 ft. 6 in. above rail level and contains six revolving chairs similar to those in the body of the car. A small stairway leads up to the platform, and neat brass railings placed on either side of the steps and on the side of the platform next to the passage, prevent any violent or undignified descent of passengers from platform to car floor.

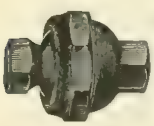
The passengers enjoying a view from the windows of the cupola have the same opportunity for observation which usually falls to the lot of the conductor and rear brakeman when traveling in the cupola of the "dog house" at the end of a freight train. In fact this coach is a very luxurious caboose, and the idea was probably derived from what is, on Canadian railways, called the conductor's van. The passengers in the cupola, however, enjoy the varied mountain scenery without the discomforts or responsibilities of freight trainmen.

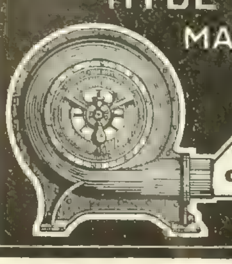
The car provides seats for 26 passengers in all and is used principally over the Selkirk range between Donald and Revelstoke. A little way west of Donald the line leaves the broad Columbia river and turns abruptly to the left into the narrow and rugged canyon of the Beaver. It is like turning into an alley out of a wide street. The ascent through this gorge is at first made on the right bank of the stream, but as the valley opens out, the river is crossed and the ascent of the eastern slope of the Selkirks is begun in earnest. Rogers Pass is the station at the summit of the grade. With snowcapped Mount Carroll and the Hermit towering on either side of the pass, it is hard to realize that the railway line is there 4,300 feet above the level of the Pacific Ocean. The road winds on down the west slope, past Mount Sir Donald, Pyramid Mountain and the Glacier, through the grandly picturesque valley of the Illecillewaet river.

Railway Motor Cars.

British railways are beginning to feel the competition of the trolleys in local traffic, just as some of our own railways



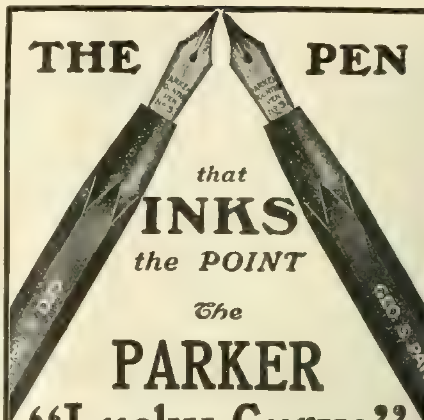




are. To meet this successfully some are putting electric trolley cars on their own roads for short runs. The North Eastern Railway has recently placed an order of large four-cylinder petrol engines, each capable of developing 100 horse power, to be used in the propulsion of light and frequent trains in local service. The cars will be 53 feet long, and will provide seating accommodation for 52 passengers, by means of reversible-back garden seats. At one end of the car there will be a Napier petrol engine of 85-brake horse power, with four cylinders; the engine will drive a dynamo, generating electricity for two motors, which will apply the power to the bogie underneath the engine compartment. The body of the car will be much lighter than the ordinary carriage, approximating closely to the tram type, with an engine compartment at one end and a conductor's compartment at the other. It will be entered from the side by doors at each end, which will be closed when the cars are running. The car may be driven from either end, and as it will carry 30 gallons of petrol it is anticipated it will work for five hours at a stretch without replenishing. The full height of the car from the ground is 13 feet. It will be fitted with electric brakes and illuminated by electric light.

Messrs. J. W. Duntley, J. R. McGinley, Jos. Boyer, W. O. Duntley and J. D. Milliken, a committee representing the directors of the Chicago Pneumatic Tool Company, have returned to Chicago after a visit of inspection to the various plants of the company. In speaking of the trip one of the gentlemen said: "This tour was one of the most pleasant experiences I have had for some time. We visited the air compressor plant of the company at Franklin, Pa., first, and were highly pleased with the conditions of affairs there, the facilities of the factory being taxed to their utmost capacity to fill the orders which are steadily flowing in. From Franklin we visited the plants at Cleveland, Detroit and Aurora, Ill., and are very well satisfied with the conditions everywhere."

The Philadelphia & Reading Railway Company has just started a watch department. Its head is John Miller, an expert on watches and clocks, and his task that of maintaining a standard of time among clocks at the stations throughout the system. The company will insist that each engineman, fireman, conductor, brakeman, dispatcher and stationmaster in its employ shall own a watch of a standard grade. The company will sell these watches to such employees as do not own them, on an easy-payment plan. We do not know what the "standard" is going to be, but it will be different from the practice of other roads if the standard is not the watch which gives the best rake-off to the inspector.



The Joker.

A striking little piece of advertising by a well known railroad is called "Our Leading Cards No. 1—The Joker. It beats everything." In center of the "card" is an American eagle, and across his breast and wings is a representation of the Empire State Express. The choice of a bird of strong and swift flight makes an appropriate background for the New York Central's famous train. We always associate a bird with rapid motion. It recalls the description Kipling gives of the passing of trains near a country residence in England. He says: "The trains of the Great Buchonian went by with a bee-like drone in the day and the rustle of strong wings at night." Mr. Geo. Daniels has certainly put his train "up to" the American Eagle, who will no doubt feel bound to award the N. Y. C. the laurel of fame which he holds in one claw and the three arrows indicating sureness and swiftness which he holds in the other. If any one hereafter misses these accessories to the national emblem they will likely be found in the Grand Central station, New York. Try the general passenger agent's office first!

The Falls Hollow Stay-Bolt Company are telling their friends that the year 1902 has been a banner year for them, and that the outlook for this year is even brighter. The hollow stay-bolt is, they say, increasing in favor, though the company supplies solid stay-bolt iron made of the same high grade double refined charcoal iron, as that used in the hollow bolts. The Republic Railway Appliance Co., of St. Louis, have been appointed the southwestern agents for the Falls Hollow Stay-Bolt Co. Mr. E. S. Marshall is president of the Republic Co. He has been S. M. P. on several of the leading roads in the West, and knows all about stay-bolts. Mr. Marshall is not only a first class business man, but one whom it is a personal pleasure to meet. The Falls Stay-Bolt Company may be congratulated on their new connection.

The "Soo" road is making a test of ignite briquettes on one of its locomotives in Minneapolis. If it proves successful the anthracite coal problem for the railroads in this part of the country, at least, will be solved.

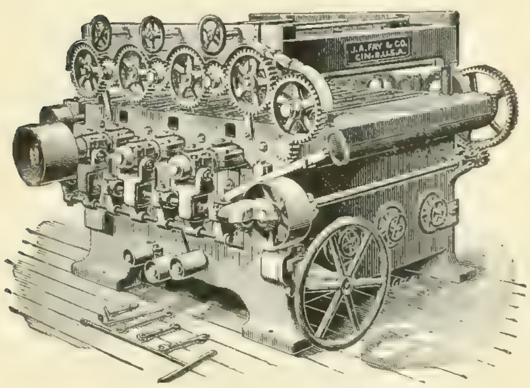
The briquettes are manufactured by an entirely new process invented by R. J. Schimper, of St. Paul. They are produced by compressing lignite, and according to Mr. Schimper, surpass anthracite in heating power.

As the new fuel can be retailed with a profit at little over a dollar a ton, a great saving will result.

New Patent Sanding Machine.

The cut reproduced here is of a sanding machine especially designed for makers of wagon, carriage, furniture and piano material. It has embodied in its make-up new points to insure it doing good work to those having this class of sanding to do.

This machine is invaluable where a perfectly smooth surface is desired, either for varnishing or painting. It is massive and substantial, and saves the work of several machines for doing this character of work. The three steel polishing cylinders upon which the paper is placed have a vibratory motion to prevent the formation of lines, and are equipped with a device for quickly



NEW SANDING MACHINE.

applying the sand paper and giving it the proper tension. Each cylinder carries a different grade of paper, the third cylinder giving the final and smoother finish.

The feed is very powerful and consists of eight feed rolls, four above and four below, driven by a train of heavy expansion gearing, and which will open to receive material eight inches thick. The machine is made to work material from 30 to 80 inches wide, and has a brush attachment which cleans the stock after it has passed through the machine. The pressure rolls are so arranged that the adjustments can be made easily, quickly and accurately, and the feed started and stopped instantly.

The makers of this improved sander, J. A. Fay & Egan Co., Cincinnati, O., will be glad to hear from those interested, to whom they will submit prices, information and cuts showing it in detail. They will send free their new and complete catalogue, showing every machine they make to those interested who will write for it, mentioning this paper.

The engineers and other trainmen of the Santa Fé and the Southern Pacific are making great efforts to stop the practice of double heading trains. They talk of striking as a means of carrying out their objections to the second engine.

Wonderful Scales.

The grand balance or scale used in the Bank of England is probably the most wonderful piece of mechanism to be seen anywhere. It stands about seven feet high and weighs probably two tons. This scale is so perfectly adjusted that it can weigh a grain of dust or 400 pounds of gold. A postage stamp placed on one of the two weighing portions will move the index six inches. If the weight placed upon the scale is beyond its capacity an electric bell is set ringing, the machine declining to execute a task of which it is incapable.—*Ex.*

One of the great inventions for a railroad, although simple in its appearance, was made in Utica, N. Y., by a blacksmith. It was the fish-plate, that connects the two rails, and is held by bolts passing through the rails, taking the place of the old cast iron shoe. The blacksmith never made a dollar out of it. Had he availed himself of the opportunity and obtained a patent, he would have been the richest man in Utica. The chilled-iron-faced car wheel was also invented in Utica, by a man named Peckham. He also neglected to take out a patent and made nothing out of it, but a man by the name of Dodd, Rochester, secured it in some way and made a fortune.—*Merchants' Advocate.*

In the Baldwin Locomotive Works record of recent construction No. 39 are shown some typical engines among which may be mentioned a Prairie-type 2-6-2 for the El Paso & Northeastern, a Vauclain compound 2-4-2 for the Southern Pacific, another of the same class for the Chicago, Milwaukee & St. Paul, a Prairie-type engine for the C., B. & Q, a compound Mogul for the Quebec & Lake St. John Ry., a 4-4-0 for the Potomac, Fredericksburg & Piedmont Railway, with 3-foot gauge and an Atlantic type 4-4-2 for the Washington and Plymouth, also for 3-foot gauge. There are fourteen half-tones in all.

Leland Hurd, a ten-year-old schoolboy of Huntington, Indiana, writes expressing great admiration for RAILWAY AND LOCOMOTIVE ENGINEERING, and tells us that he intends to be a locomotive engineer. To show his familiarity with engines, he wrote down a list giving the names of 64 parts of a locomotive. Our youthful admirer seems to know a good deal about locomotives, but as he grows up we have no doubt that his ambition to be a locomotive engineer will encounter chilling influences, as he is not surrounded by railroad people, but is the son of a lawyer.

To a contented mind, a closet is a palace.—*Martin Chuzzlewit.*

Railway and Locomotive Engineering

Copyright by Angus Sinclair Co. 1903

A Practical Journal of Railway Motive Power and Rolling Stock

Vol. XVI. 174 Broadway, New York, March, 1903 No. 3

Railway Building and Scenes in Cuba.

The latest feat of expeditious American locomotive railroad construction has just been accomplished in Cuba.

At the time of the surrender of the

OLD WAR TIME ENGINE NOW ON CONSTRUCTION

island by Spain to the United States in 1898, the greater half of Cuba—from Santa Clara down to Santiago de Cuba—a distance of some 450 miles in length, and covering an area of about 30,000 square miles—was wholly unprovided with railway communication and practically a vast extent of country rich in mineral and other wealth, remained undeveloped and virtually unexplored.

Immediately upon the cession of the island to America, the late President McKinley, wisely realizing the efficacy of commercial enterprise in preference to political influences in the real and successful betterment of a newly acquired country, deputed Mr. Robert P. Porter to visit the island, to inquire into and report upon its industrial, commercial and financial condition.

In the portion of his report, dealing with railways, Mr. Porter stated:

"The railway system of Cuba, consisting of seven companies—the aggregate length of whose lines is only 917 miles—is entirely inadequate in bringing the extreme ends of the island together—Santiago and Havana in point of time being as far apart as San Francisco and New York, though only separated by a distance of a few hundred miles.

"The facts gathered on this subject point to the advisability of immediately constructing a trunk railway from end to end of the island, with branches ex-

CONSTRUCTION TRAIN

tending north and south to the important cities and ports. From whatever standpoint it may be viewed, no one enterprise could do so much to improve the situation on the island. No revolution could have existed in Cuba if such a railroad had been completed by the former government, and nothing will so rapidly tend to the revival of commerce and general business as the facility for quick passage from one end of the island to the other, and from the trunk lines over branches to the seaboard cities. All political turbulence will be quieted thereby and prevented in the future. The entire country will be open to commerce, lands now practically of no value and unproductive will be worked, the seaport towns will become active and commerce between the island and the United States will soon be restored to its former figures. After a careful study of the situation, it would seem extremely doubtful if such an enterprise could be made a commercial success for many years to come."

The concluding words in Mr. Porter's report were certainly not encouraging to a national undertaking of a new and much desired railway system, nor, in fact, did they in the least stimulate any private enterprise in that direction. The prospect of a reasonably immediate profit was not sufficiently promising.

Undaunted by the guarded warning, however, Sir William Van Horn, with a characteristic spirit of venture and sage foresight at once seized upon the opportunity, and got together a few influential kindred enterprising railway magnates, with British-American interests and influence, and formed a corporation with the object of carrying out the sug-

gestions contained in Mr. Porter's report at all hazards.

Without loss of time, Sir William engaged a competent body of practical men to go over to Cuba to make a preliminary survey of the country, and in less than a year afterwards, the whole area was completely surveyed, the route mapped out, and the constructional work actually begun. Sir William Van Horn personally traversed the route, made a careful inspection of the undeveloped portion of the island, gathered samples of the various soils for analysis, and what is not uninteresting, he utilized an old Spanish wood-burning armored locomotive (which was used during the war) for constructional purposes.

CLEARING THE JUNGLE

In less than three years the entire line of railway—about 400 miles—running through the very heart of the eastern portion of the island, has been finished without a hitch, and the whole system has just een opened for public traffic.

In preparing for and building the track considerable difficulty was experienced in excavation work, clearing the jungle and spanning over rivers and valleys. Great care was exercised in executing the permanent way and the most modern appliances and materials were brought into use, and the whole track is now reported to be in a highly satisfactory condition.

The new railway is of standard gauge, and its bridges are of steel and masonry; its equivalent will be similar to that of the best American railways, and it is intended to run through sleeping cars between Havana and Santiago de Cuba.

The main object of the enterprise is "the development of the eastern and larger part of the island of Cuba, which consists of large areas where hitherto no railway facilities have existed."

The main trunk line establishes a direct rail connection between Havana, Santa Clara, Sancti Spiritus, Puerto Principe and Santiago de Cuba. Cross and branch lines are being constructed between Santiago and the Bay of Nipe; Ingaro and San Fernando and two smaller sections will connect the main trunk line with Sancti Spiritus and Holquin.

The country thus opened out is said to contain much undeveloped mineral wealth, large areas of land of the richest description, and an ample supply of good water. The mountainous regions are extremely picturesque, but sparsely populated and for the most part little known. The new line will open up a great extent of new and attractive country for settlement and cultivation, and will add largely to the attractions Cuba offers to tourists, for it will make many important and interesting places and districts easily accessible, which have hitherto been difficult to reach, and which have been rarely visited.

Sir William Van Horn and his colleagues are to be congratulated upon the successful and rapid completion of their admirable undertaking. Cuba will now enter upon a new and brighter era. The possession of railway facilities must very soon tend to ameliorate the existing Cuban political and economic conditions and difficulties, enhance the commercial prosperity of the country, and consequently conduce to the improvement of the inhabitants far more effectually than the wisest of legislative enactments or the most reasonable of treaties.

J. W. DAVIES.

The Canadian Pacific Again Goes to Scotland for Engines.

The Canadian Pacific have placed an order with Nelson Reid & Co., Glasgow, Scotland, for twenty locomotives. They are simple, ten-wheel engines, 20x26 in. cylinders, 60 in. drivers, and weigh in all 164,550 lbs. The tractive force of these engines is 27,100 lbs., and the ratio of tractive power to adhesive weight is 4.7. The engines are practically Canadian Pacific standard, with improvements made by the designers, Mr. E. A. Williams, superintendent of rolling stock, and Mr. A. W. Horsey, chief draughtsman. Piston valves are used, having inside admission, thus giving incoming and outgoing steam as direct a course as possible. The valve gear has been designed so as to make it straight, thereby doing away with the motion connection bar, which reduces the number of parts to a minimum. This has been achieved by placing the center of the piston valves in line with the center of the frames, and using a rocker which swings on a pin

MAKING A CUTTING

fastened in the frame, giving a very direct motion in forward gear. The spring gear is underhung and is central with the driving boxes, the connection comes down from the underside of the box. The tender is C. P. R. standard turtle-back, hopper tank. The tender frame is made of 10-in. steel channels. The trucks are also made of steel and iron, with outside carrying springs.

The inability of builders in the United States and Canada to fill the order in the time required has given the Glasgow firm an opportunity to build a very serviceable and well designed machine.

LABORERS IN SUGAR CANE FIELD

Hollow Car Axles.

It is well known that a given amount of metal arranged in the form of a tube will possess greater rigidity than as a solid bar. The principle was long ago utilized in the formation of the square columns of steel frame buildings. Lately it has been applied to the immense shafts of ocean steamships, which are subjected to severe bending as well as twisting strains. A hollow shaft is stiffer than a solid one of the same weight. The most recent use of the idea is in the manufacture of axles for cars.

The Pressed Steel Car Company, of Pittsburg, are fitting up an experimental car with a new design of hollow axle made by the Howard Axle Company, at West Homestead, and which is controlled by the Carnegie Steel Company. The axle is made under the Mercader patent and it is claimed for it a greater efficiency, less weight and one-fifth the machinery necessary in preparing the solid axle. The experimental car is to be put in the local trade of the Pittsburg district, and after being in use six months will be examined to ascertain the wear on the hollow axle. A car fitted with solid axles will be put in the same service and a comparison made of the efficiency of the two cars in the same traffic and with equal burden.

A Combination of Book and Brain.

BY SHANDY MAGUIRE.

In these days of educational schools and papers devoted to every-day railroading, wherein readers and pupils are taught to do everything from how to screw on a nut to shooting the planets as they fly, there is a wonderful improvement in many directions. Old times, old methods and old men are relegated to the back track—or should be there—in the estimation of the up-to-daters, who boast superior thinking machines than their daddies used to own.

Terry Bennett didn't take much stock in the "poll parroting" of the new school, as he designated the men of to-day, who are in the saddles, and, as he supposed, riding in a hand gallop to Hades. Time was when he could take his applicants for any position and "put them through their facings." If a young fellow made application to him in the lamented past for the position of fireman, he would send him out on an engine with a regular double-breasted son of the scoop, as chaperone, and tell him to find out of what sort of stuff he was made before he got back.

All that has been changed, and Terry is glum accordingly. One day a wiry looking young chap, about 4 and 20 years of age, came into Bennett's office with a letter from the division superintendent, telling him to "put the bearer, George Raleigh, to work as fireman, on the line of promotion."

Dear old Terry read the letter carefully, and after its perusal he gave a most paternal look at the young fellow who stood before him with all the self-possession a coming engineer could be endowed with. "Are you George Raleigh, the man so favorably mentioned in this letter?" "Yes, sir," he responded, "and I suppose you are Mr. Bennett?"

"Sometimes I am, particularly when my wife puts my name down on some subscription paper in a most generous manner, so as to impress all hearers with the weight of my purse; at other times, and under different circumstances, I am plain Terry Bennett, and much oftener I am Old Terry. Well, it is not of much importance, anyway, what I am called. It will not disturb our future relationship. I see you are a graduate of the Engineering Correspondence School, well recommended, and have been an apt scholar; have you any experience?" "No, sir, but I have a fair knowledge of combustion."

"That won't hurt you any, if you are only apt enough to put it into practical

LOADING SUGAR CANE

effect when you stick your nose in the firebox. I suppose you are educated into the knowledge of the component parts of coal?"

"Yes, sir; it is composed of gaseous matter, moisture, fixed carbon, ash and other elements. I feel that I can master the position."

"There are others who thought the same, whose heads are gray, and whose eyes are dim, trying to master it, looking at the firebox, then at the pointer, then at the schedule, then at the dial of the watch. Look at the turkey-trampled phiz of the old grizzled mug of the chap addressing you."

"What school have you a diploma from?"

"Oh, listen to that now!" said Terry, in astonishment, looking toward his clerk, who pretended to be very busy in a pyramid of figures, and who would tell broadcast every word of the interview before the sun would set. "From the school of experience, in which I have been toiling for a diploma for nigh upon forty years, and have not received it yet."

"You deserve credit for doing so well in life as you have, considering your lack of knowledge scientifically taught."

"Say, young fellow, I think there is some good stuff in you, judging you by the fluency of your gab, and I am going to find it. Report to Tom Purdy, who goes out to-day on the Quickstep."

Terry was astonished at the gall of the applicant, and it did more to get him immediate work than if he came with a dozen letters. He wanted to satisfy himself if the young fellow had anything in him besides talk.

He sent for Purdy. "Tom," said he, "I am going to send you a chap to-day who comes well recommended. He wants to be an engineer—some time. You keep your eye on him, and see that Pug Miller does not do him up the first trip, and report to me on your return."

Purdy reluctantly drawled out "All right."

"Now, Tom, you do not take kindly to my instructions. Why?"

"You send me more than my share of students. Can't you send this one to Paddy Ryan?"

"No. Paddy is prejudiced against all modern methods. He thinks no one can be an engineer unless he climbs from the pit up."

Purdy introduced George Raleigh to Pug as soon as they came around to go out. Pug snarled "Glad to meet you," with a scrutinizing look that contained the essence of all the disgust of Pug's nature, which was considerable.

The Quickstep was a soft-coal burner and a fairly good steamer. Bennett's policy was to have an applicant make five trips over the division with an experienced fireman, then leave him alone on the same engine for five more, provided a good report came into his office from the new beginner at the end of the five gratis trips. Pug got down to business after the train got out of the yard. He put in the hook, watched the top of the stack and was satisfied, as he should be, if it was black smoke he was after; then three, four and five scoops of coal and a flop onto the seat, until time to go at it again.

TOBACCO FIELD.

After they were out about 20 miles Purdy said: "Pug, let the young fellow try his hand."

"Wait till we get to Baily's," said Pug.

"No; let him at it here on the straight."

Pug had to obey. Baily's was the foot of a 14-mile grade, and Pug wanted to postpone the slaughter of the innocent till he got there, as he had often done before, but Purdy wouldn't stand for it this time, as he said afterward, "because I liked the looks of the youngster."

Raleigh got into position. He gave a look at the gauge. The pointer stood dancing a jiggeree at 160. He proved an apt pupil. In the 20 miles he rode he kept his eyes open. He scattered never more than three scoopfuls of coal all over the surface and watched for results. He kept this up for seven or eight miles, and the pointer was coming down to hold a chat with him, for it stood at 130, Pug's face at a broad grin and Purdy's at anxiety for the meet ahead. Raleigh went lively for the rake, and after a rapid scan of the surface, he raked over the fire, closed the door, got the tool out of the way as quickly as an old veteran, and awaited results. The pointer began to forsake the 130 mark and go up again. The young fellow followed up his advantage and manipulated things so that he gained all the ground he lost, and seemed to do it without ever letting anything darker than a sort of a tawny-colored smoke belch from the stack at its most active delivery. One hundred and sixty on a move! and the apprentice up smiling, while Pug looked disconsolate. Baily's was near, and the Quickstep ready to climb it, with George Raleigh at the furnace door. "Over the hills and far away," was the song lilted up by Purdy to nag Wilson.

There was nothing worthy of special attention occurred until the day's work was completed. Raleigh acted like an old hand. Pug sent word to Bennett he could not go out next day, and he being short of men, went to advise with Purdy.

"I'll go it alone with the young fellow," said Tom.

"I don't think it safe; but I have confidence in your judgment. Do you think him capable?"

"He is the brainiest and wiriest fireman you have to-day. There isn't any question I ask him relating to steam, air, water and fuel but he can answer with the speed of a school-car lecturer. You watch that chap's smoke, Mr. Bennett, and if he doesn't make his mark in the railroad world before he sees the first gray hair in his little blond mustache, you can shoot me for a Dago."

Pug Wilson was off sick for about five weeks—with a fit of the yellow jaunders, as Paddy Ryan called his ailment—and George Raleigh remained on the Quickstep until his return, then he was put chain ganging on the extra list.

One night Paddy Ryan's fireman was off, and Raleigh being first out, was allotted to him. His fame had been abroad over the division for some time as the "know-all dude," by those who could about sign their name in a sort of a text between hieroglyphics and scrawls. Paddy was tainted with the disease to a certain extent and Raleigh knew it. However, he did his work, and gave no reason for Ryan to find fault.

Just as the engine struck the foot of Baily's Hill a tremendous blow occurred in the cylinders, or steam chests, obliging Paddy to close the throttle valve. When the train was stopped the crew came to the engine to know what was the trouble. Ryan wanted to locate the blow by moving the engine, but couldn't move either ahead or back, with the train and the enormous loss of steam blowing away. It was evident that Ryan was confused when he began to take suggestions from the train crew, who knew nothing about what they were talking. Paddy got up again into the cab to try and move the engine so as to put it on an available point for procedure. He was followed by Raleigh.

"Mr. Ryan, said Raleigh, "please excuse me for having anything to say to you, but I know a way to locate the side the blow is on without moving the engine. I did not want to speak to you before others."

"You?"—"Yes, sir."—"How?"

"Open the front end and you can tell by seeing which exhaust pipe the steam roars out of."

"Say, you're right. Why didn't I think of that before? Who told you?"

"Locomotive Engine Running and Management told it to me nights at home."

Ryan said no more, but opened the front end and found the side the trouble was on. He then whipped off the steam chest, and saw a broken valve yoke. The rest was plain sailing, for Paddy, although a graduate from the pit, was no fool. He was not able to go up Baily's Hill on one side with his train, but he flagged back to the first switch and left part of it there, and then he went along. After they got moving again, Paddy nodded his head to have Raleigh come over beside him.

"George," said he, "I have been bigoted all my life against theoretical chaps coming on locomotives, of whom I supposed you were one, but to-night you've taught me different. You also acted delicately by not showing all hands you knew more than me. See that fist, George, it is no baby's; and there is muscle enough behind it to push it into a fellow's face for a knockout who'll ever say a word against you in my hearing any more."

Six months later George Raleigh was round-house foreman at Baxter. After 14 months he was appointed division master mechanic; and to-day he is superintendent of motive power and equipment on a certain trunk line, giving the best of satisfaction to all parties concerned, gained by his devotion to study of the most available authors, after his trips were made, comparing his own experience with that of them, and profiting accordingly, instead of being a prominent member of the Stove Committee or some other assemblage of kickers, who think they know it all.

Locomotives for Japan.

Although it is reported that the Imperial Government railways of Japan intend to experiment with locomotives of American, British, German and Russian construction, the independent railroads of Japan are inclined to adopt the engines built in this country.

Joseph W. Crawford, engineer of branch lines of the Pennsylvania Railroad Company, is closer to the Japanese railroad officials than any other man in this country. He assisted in constructing the imperial railways of Japan and lived in that country for several years. Although he is in no way officially connected with these railways, no innovation is made by their officials without consulting Colonel Crawford. It was through him that American rails were purchased.

A few days ago he let an order with the Schenectady Locomotive Works, of the American Locomotive Works Company, for the construction of twelve Mogul locomotives for the independent railroads, to be delivered early this year. It is understood that a larger order is to be placed later.—*Philadelphia Press.*

Great Call for Locomotives.

Six complete locomotives are now turned out daily at the Baldwin Locomotive Works, but even with this supply the demand for motive power by the various great railway systems cannot be met. John H. Converse, president of the Baldwin Company, said yesterday that the present condition of affairs was unprecedented.

"We are working continuously, night and day," said Mr. Converse, "and we are turning out on an average of one complete locomotive every four hours. The various branches of our plant are rushed with work. The demand for motive power by the railroads does not seem to slacken, and it reflects the general prosperity of the country."

From Monday morning until Saturday night not a wheel in the Baldwin plant ceases to turn except by accident, and 13,000 men are kept at work. The order of the Pennsylvania Railroad Company for 350 locomotives, placed some time ago, is being rapidly filled. For this road alone the Baldwin Company is delivering seven complete locomotives every six days.

A Pennsylvania official said yesterday that this meant a great deal to labor in general, with the fact that the road's Altoona shops were sending out a complete Pennsylvania locomotive every two days. —*Philadelphia Ledger.*

TYPICAL HOUSES IN SANTIAGO.

George H. Daniels on Railroads.

George H. Daniels, general passenger agent of the New York Central Railroad, was the guest of honor and principal speaker at the second reception and dinner of the Baptist Social Union of Buffalo, held in parlors in the Niagara Hotel. He spoke on American Railroads and Our Commercial Development. In part, he said:

"In all ages of the world, transportation has been as it is to-day, associated directly with the advancement of the human race. It began with the dawn of the world with the human burden carriers; then in certain countries came the dog, the burro or pack mule; in others the horse, the camel and the elephant; the sailing vessels, the canal-boat; the steamship; the stage coach, the horse car and the railroad. The steam railroad

is the highest type of transportation. When I tell you that all the money in the world, gold, silver and paper, would not buy one-third of its railroads, you will get some idea of the vastness of this industry.

"Railroad mileage has grown steadily until now we have 200,000 miles of steam railway in the United States. These railroads employ over 1,000,000 men, whose wages amount to over $600,000,000 annually. Their capital is over $12,000,000, and their earnings last year exceeded $1,500,000,000. They carried more than 600,000,000 passengers last year, and 1,100,000,000 tons of freight.

"In 1851 there were a little over 9,000 miles of railway open for trafic in the United States. In 1903 there are over 200,000 miles in operation. One hundred years ago the Governor of the great State of New York advised his friends not to invest their money or a day passing over the New York Central alone.

"American railroads have always been aggressive. They do not wait for business; they go out after it. The whole world is their field. They keep in touch with every change in every country. Their maps are so accurate and up to date that they are used by students in studying geography, and remarkable as it may seem, in at least one case they proved of service to capitalists for information about foreign fields for investment. Within two months after the signing of the Paris treaty that ended the Spanish-American War the New York Central Railroad had ordered new maps from the Matthews-Northrup Works to show the changes the war had wrought in the geography of the East.

"It is beyond question that American railroads to-day furnish the best service at the lowest rates of fare, at the same

BELOW BLOODY BEND, SAN JUAN HILL.

waste their time in aiding the building of railroads, expressing the opinion that, while it was possible that improved methods of construction and perfect machinery might in the remote future enable the people to move a car upon railroads at the rate of five or six miles an hour, he did not believe they ever could be made of material advantage and that any attempt to transport passengers and freight by railroad from one part of the country to another must result in endless confusion and loss. Less than a quarter of a century ago upon the average American railroad the capacity of a freight car was 20,000 pounds; the capacity of a freight engine was from 20 to 30 such cars to a train. To-day on the New York Central the capacity of the grain cars is from 60,000 to 65,000 pounds and a locomotive of the latest type will haul from 75 to 90 such cars loaded to their full capacity. During the busy season there are from 75 to 100 such trains time paying their employees very much higher wages than are paid for similar service in any other country on the globe. The fact that American passenger service attracts the attention of people of every other country who visit our shores is demonstrated by the desire of all foreigners to ride on the Empire State Express and the Twentieth Century Limited—the fastest long-distance train in the world—and the further desire to examine the magnificent machines that haul our great trains. This is the age of transportation and the United States is leading the world."

To Remove Sparks from the Eye.

Most people know of the more apparent dangers to which railway engine drivers and stokers are exposed, but few know that the form of accident to which they are, beyond all others, most subject is injury to the eyes.

Small particles of cinder and metal are constantly getting into the eyes of the drivers and stokers, and sometimes, when the pain is agonizing and difficult signals have to be understood, the danger and inconvenience are not small.

But these men have only one method of giving each other relief—a method that, however unpleasant it may seem to the average reader, is declared by the most eminent surgeons to be the one practical, feasible plan, and one that shows how devoted these co-workers can be to each other.

And the method in question is this: Directly the stoker, say, gets some stinging particle into his eye the driver will firmly, yet delicately, open the eyelids wide and then lick out the unseen fragment—that is quite capable of producing tragic consequences—with his tongue. The public know little of this heroic remedy, but on every line in the world it is being applied daily.

Surgeons, with all their beautiful instruments, recognize that the way in question is, when the foreign substance is of metal and one that cannot be seen, the only plan.

Thirteen O'Clock.

The New York Central Company track managers are making preparations to place time clocks along the tracks. These clocks are to be rung every hour by the track-walkers and are intended to prevent the trackmen from sleeping in shanties.

This is in line with an act of the Duke of Bridgewater, who built a canal through Lancashire and beyond in England about a century ago. The workmen's dinner hour was from 12 to 1 and His Grace found that they were far from punctual in beginning work after the meal hour. On remonstrating with his foreman about the loss of time he was informed that the people interested failed often to hear the clock strike 1. His Grace was equal to the occasion. He had a clock made which struck thirteen times at 1 o'clock, and it is still ringing these many strokes in a village near Manchester.

Many people conclude that locomotive builders are peculiarly fortunate at present in receiving orders that keep them filled up for a year or more, but there is a reverse side to this record of good fortune. The building companies say: How are we going to figure on the cost of the engines a year hence? Material, labor and every item that goes to build up the cost of a locomotive are rising. We try to strike an estimate of what the total rise may be, but it is easy to make a mistake. Prosperous times have ruined more locomotive companies than hard times. This sounds like a paradox, but it is true.

Growth of the Locomotive.

By Angus Sinclair.

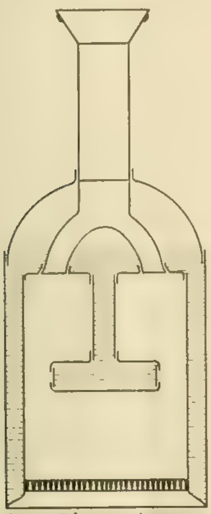
(Continued from page 80.)

POPULARITY OF VERTICAL BOILERS.

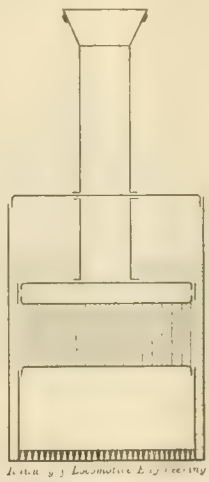
The pioneer railroad engineers and inventors of locomotives in the United States worked out for themselves what they considered the best form of boiler, but much unproductive labor was expended before the fittest was developed. Vertical boilers were in highest repute among American designers evidently owing to the success of Cooper's small locomotive, but some very expensive blunders were made before inventors settled down to the use of tubes in horizontal boilers for transmitting the heat from the fire to the water.

THE "CHEESE" BOILER.

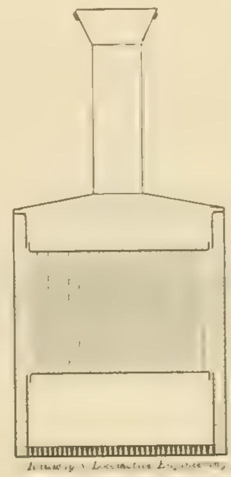
The engine built at York, Pa., by Davis & Gartner had a boiler of the form shown in Fig. 10. In this boiler a circular water table was used for increasing the heating surface, but it did not work well. The water-table was known among railroad men as "the cheese." It filled up quickly with mud and scale and soon burned out, and was replaced by a boiler of the form shown in Fig. 11. This is a tubular boiler with a combustion chamber, and was a great improvement over the cheese boiler as a steam generator. Still a greater improvement was effected in the boiler (Fig. 12) designed for the "Atlantic." That was a more powerful engine than any of those previously tried and it weighed 6½ long tons, or 14,560 pounds. The cylinders were 10x20 in. and the driving wheels were 30 in. diameter. The steam pressure carried was generally 50 pounds above the atmosphere.



CHEESE BOILER.
Fig. 10.



IMPROVEMENT ON THE CHEESE BOILER.
Fig. 11.



"ATLANTA" BOILER.
Fig. 12.

COST OF OPERATING.

In 1832 Jonathan Knight, the chief engineer of the Baltimore & Ohio Railroad, reported that the engine hauled a gross load of 50 long tons from Baltimore to Parr's Ridge, a distance of 50 miles, up an average grade of 37 ft. to the mile, at a speed ranging from 12 to 15 miles an hour. The daily expense of the round trip of 80 miles was $16, which included one ton of anthracite coal at $8 a ton; engineer, fireman and laborer, $3.50; oil and packing, 50 cents; estimated wear and tear and interest on cost, $3.00; water station expenses, $1. The engine did the work of 42 horses, the daily expense of which was estimated at $33. The first cost of the engine is not given, but it was about $4,500.

These figures are interesting as indicating the prevailing rate of wages at the beginning of the railway era, and also the price of anthracite coal.

FIRST RAILROAD MACHINE SHOPS.

The first two engines for the Baltimore & Ohio were built in the machine shop of Davis & Gartner at York, Pa., because the railroad company did not have facilities of their own for building locomotives. The shops at Mount Clare were, however, ready in 1833, and after that all the engines for the company were built there, although the shops were under the charge of Phineas Davis, who proved himself to be a first-class mechanic and engine designer. At the same time George Gillingham was superintendent of machinery and the ingenious Ross Winans was his assistant.

Mr. Davis came to an untimely end. The following extract from the minutes of the Board of Directors of the Baltimore & Ohio Railroad Company gives the sad particulars:

PHINEAS DAVIS.

"When adverting to what has been accomplished in the improvement of the locomotives of the company it would ill become the board to omit paying a tribute of merited respect to the memory of Phineas Davis, the lamented individual who so largely contributed to the results here indicated. On September 27 [illegible] last he, having completed a new engine, availed himself of the occasion of trying it to take his numerous workmen on a visit to Washington. On his return the engine, striking the end of a rail, which the breaking of the iron chair had permitted to get out of alignment, it was thrown off the track and, being on the tender, he was dashed forward against the engine and instantly killed. No other person was injured.

"Phineas Davis was the first who constructed an engine capable of being used on the road in which anthracite fuel was successfully employed. With untiring patience he bore disappointment after disappointment, and the eminent and splendid results which ultimately rewarded his efforts are ample testimonials of his genius, and will identify his name most honorably with that great system of internal improvement which is yet to work so many and important changes in the relations of society. Of a quiet and clear perception in matters relating to his profession, he possessed a calm, discriminating judgment. The warmth and energy of inventive talent were tempered by a prudent foresight and great practical skill. He seldom, therefore, took a step which was not a secure one, and the success of his suggestions when put into practice gave them from the first almost the same weight as if they had been the dicta of experience. His private worth and unassuming manners were not less remarkable than his rare abilities. The board deeply regret his loss, and hold his memory in sincere and respectful consideration."

OBJECTIONS TO VERTICAL BOILER AND CYLINDERS.

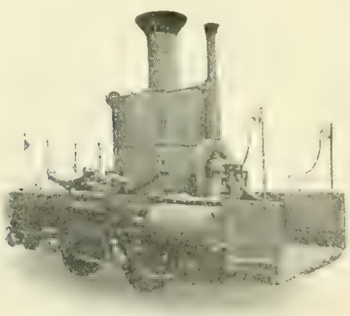
After the death of Davis the company's shops were leased to George Gillingham

and Ross Winans, and they built new grasshopper engines and repaired all the rolling stock under a contract. Between 1831 and 1837 about 20 grasshopper engines were built, one or two of them for foreign railroads. By degrees the inherent weakness of that style of locomotive began to assert itself. The vertical cylinders tended to impart a bobbing motion and the vertical boiler made the engine top heavy, a defect which was aggravated by the short wheel base.

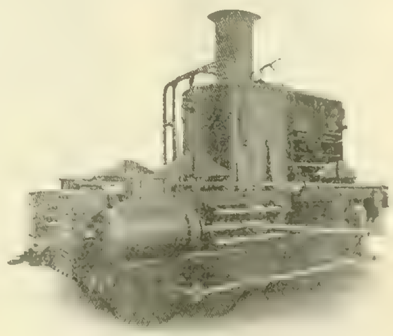
CRAB ENGINES.

The first deviation from the accepted form of the grasshopper engine was to apply the cylinders in a horizontal position while retaining the boiler upright. The engines of this type were built and the workmen called them crabs, because they seemed to run backward. This name became historical.

Placing the cylinders horizontal helped to overcome some of the defects of the engines, but they were never adapted to the high speed that other kinds of locomotives attained during the first decade of the railroad era. On the Baltimore & Ohio Railroad the capacity for hauling freight was of more importance than speed, and we find the improvements effected by Winans on the locomotive were generally intended to increase the tractive power.



CRAB Fig. 13



MUD DIGGER Fig. 14

MERITS OF THE GRASSHOPPER ENGINE.

Benjamin R. Lathrobe, who was for many years chief engineer of the Baltimore & Ohio Railroad, wrote about the grasshopper engine:

"The engine was constructed with special reference to the weak track and strong curves of the Baltimore & Ohio Railroad. It was made, therefore, of moderate weight and short coupled, so as to press lightly on the track and round the curves easily (the swiveling truck not having been then suggested), and that it must have done this last is proved by its being able to work itself through the quadrant of 60 ft. radius at the street corners. It was supported upon wheels of small diameter with the same views and to keep down the center of gravity, and also to give tractive power with a cylinder of moderate size and pressure of steam, such as was used at that time. The upright boiler was adopted in view of the advantages already enumerated, and of its successful use in the little engine of Mr. Cooper, which seemed to give the maximum of steam generating capacity in the smallest compass, and hence to be especially favorable to the compactness required in so short an engine. The boiler, affording readiest and staunchest support to the cylinders, was naturally resorted to for that purpose. This gave them their vertical position, and involved the lever beam and long connecting rods or grasshopper legs. The separate shaft was an accompaniment of the system of gearing required by the small wheels, and relieved of its objections.

"The fuel used required a strong blast, and this was most effectively obtained by a fan, and this, again, was most readily driven by the exhaust steam, which at the same time was made to heat the water before entering the boiler. The valve motion might have been effected by the generally employed eccentric, but the use of properly formed cams cut off the steam in a more satisfactory manner in this engine, and at a proportion greater or less according to the power to be exerted on the different grades of the road, thus economizing steam. It must then be admitted that, taking it as a whole, the engine was admirably adapted to the road on which it ran, and although it had to give place, in time, to another style of locomotive, it rendered good service and is fully entitled to have its memory perpetuated."

WINAN'S WORK ON THE LOCOMOTIVE.

Winans led the world in advocating powerful locomotives and appeared to have the clear conception of the economy that would result from the use of engines as large as the track would carry. It is only within the last decade that railroad managers have indorsed by practice the wisdom of Winans' policy. The light track which his engines had to run upon kept down the weight, but with all the restrictions imposed by weak structures and prejudice against heavy loads, he built engines that compared fairly in efficiency with those of modern construction.

The "crabs" were followed by eight-wheel engines, which the trainmen promptly denominated "Mud Diggers." They had horizontal cylinders like the "crabs," and the upright boiler was still retained. The engines would run steadier than the four-wheelers, but they were very unpopular and only two were built. They were practically double truck locomotives, a style of construction which Winans originated in a car which he built in 1830.

(To be continued.)

Mr. Atterbury Breaks the Car Blockade.

About the beginning of last month the most important problem confronting the great Pennsylvania Railroad Company was how to overcome the congestion of freight that had become too great for the facilities as usually operated. General Manager Atterbury had scarcely got settled in his new position when the freight-moving problem reached up to him. Instead of following the usual stereotyped plan of staying in his office and issuing orders Mr. Atterbury closed up his desk and proceeded to the scene of conflict, where he could watch every detail. He had very clear ideas of how freight ought to be moved expeditiously, and put them into practice. Within a few days business was moving as usual.

A method of handling coal cars which Mr. Atterbury introduced has greatly accelerated the movement of these cars. They are classified at tidewater terminals and the empties sent back to the mines in solid trains. All railroad cars not owned by the party loading them are regarded as applying to the pro rata share to each mine and distributed accordingly.

At present only Pennsylvania cars are treated in this manner. Under this new arrangement no big coal company will be able to farm out its own cars to other operators. At the same time these companies will, it is said, get more cars and the smaller shippers fewer than they do now.

The general salutary effect sought, however, is a quicker and fuller service. It is expected to discourage the use of foreign cars on the Pennsylvania, more prompt return of equipment, and so tend to relieve the company's lines of the congestion of empties, and which is one of the causes of freight blockades.

As the conversation proceeded along the line of success, a gentleman who was present made the statement, "Yes, the man who never fails, never blunders, never makes a mistake, is the man who is earning 75 cents or $1 a day digging dirt."—*Omaha Bee.*

General Correspondence.

Cause of Trouble with Valves.

Mr. R. M. Watson wants to know what is the matter with his valves? Well, he says that every man had trouble with that engine. The fault is that his lubricator was cross feeding, and as they all had trouble with that engine the steam pipes or dry pipe in boiler has a leak in one of the joints. When he is running freight and jogging along the boiler gets full of water and leaks in the joint and goes to steam chest. When running his 50-mile an hour he does not carry water so high and the engine runs better; that is, she don't get so much water in dry pipe. His valves being dry has got his left eccentric hot through too much friction, and oil-hole stopped up in eccentric made her run hot and that is what broke the blade of eccentric.

JAMES L. MORRIS.

Tiburon, Marin Co., Cal.

What Made the Reverse Lever Jerk?

In reading R. M. Watson's article about his valve gear and reverse lever jerking so badly, published on pages 13 and 14 of January number, I made up my mind that it was not caused by his valves, but was caused by his eccentrics running too close together, and the bolts that hold the blades to the straps catch each other, or interfere and would naturally interfere more when engine is drifting than when working steam. We had an engine here that tilted some of her driving box saddles over against the frame, and when they were leveled up by putting shims under the low side of the saddle, then the box ran hot. This was overcome by taking the roller off from top of saddle and turning it tapering, one end of the roller being made as much smaller than the other end as the thickness of the shim used to level up the saddle, and the small end of the roller was put to the side of the saddle that was shimmed up, thereby keeping the band of the spring in a level position, also keeping a uniform pressure or bearing the whole length of the brass which cured the heating of the journals.

Cherokee, Ia. C. D. GREIG.

Why Parts of Firebox Are Cold When Steam Is Up.

Referring to Mr. Chenworth's statement in the January number of RAILWAY AND LOCOMOTIVE ENGINEERING relative to sheets in firebox of a locomotive being cool while water is above the boiling point, I would say that it is due to the fact that water absorbs heat more readily than the iron sheets do, and the water will absorb heat that is sufficient to melt the iron sheet—therefore, a condition takes place that is not unlike a vacuum.

The reason that the sheets are not cool before the boiling point is reached is partly due to the air that is mixed with the water which hinders the water from absorbing the heat; as the water becomes hotter, the air is driven out of the water and more heat is absorbed from the plates, providing there is a sufficient volume of water in the boiler. Two inches of water on the crown sheet would not keep the crown sheet cool, but if the boiler be filled full "up to the whistle" the crown bolts would not be any hotter than the crown sheet, because they would be almost completely covered with water.

Notice a patch on a crown sheet, the rivet head of the patch will not be any hotter than the crown sheet, because it's covered with water. CARY A. BRACE.

Saginaw, Mich.

[We are pleased to publish the above explanation, although it is not altogether satisfactory.—Ed.]

Squaring the Exhaust.

I noticed a communication from "J. A. B." in the January RAILWAY AND LOCOMOTIVE ENGINEERING about a quick job of squaring the exhaust. Now I can beat his time with odds, or else I had nothing to do with it, for she squared herself with one exhaust. Engine 109 was sent to the main shop so lame that one would think she could not run, but she hauled her rating all right. The motion man ran her over and found everything O. K., then she was assigned to me in local service, and it made me tired to hear her limp so badly. On the return trip, as we were ascending a very heavy grade, she squared herself with one exhaust. Now this may seem "fishy," but I will explain. Unbeknown to the M. M. or any one else, the boiler-makers had put a bushing or false stack inside, for a reducer undoubtedly to make her steam better, or for an experiment. The supposition is that the rivets at the base wore off and let the lining swing over so one exhaust shot in between it and the stack proper. The engine was laboring very hard, when there was an unusual commotion in the firebox, and at the same instant I saw the stack, as I supposed, rolling down the hill, but on looking saw everything was all right, but my fireman's face showed utter amazement, for she was cutting off as square as a die. I called him in time to see the false stack going down the hill, and then he also looked forward, but found everything all serene. We did not stop, for it was a hard place to start, but reported it to the M. M. when we got in, and on the next trip we brought the lining in. Now it is very strange to me that, if the exhaust would throw that stack out, how "J. A. B." could keep his plugging bar in that nozzle. F. V. B.

Heat Phenomenon.

The heat phenomenon, mentioned in your January number on page 14, which was observed by Mr. Chenowith, is a common one and can be dealt with in one's own kitchen. One can take a kettle of boiling water off the stove and immediately place it on the palm of the hand without any injury to that member for the space of 30 seconds or more. As soon as the boiling ceases the circulation of water is less active; its temperature is practically uniform; convection ceases and heat is emitted by conduction. While the water is boiling evaporation is in progress, the water has a rapid circulation which causes the heat to be used up by convection. The principle may be summed up in these two words, "conduction" and "convection" of heat.

J. L. MERY.

Jerome, Ara.

The Piston Valve of To-day.

Having recently noticed an article in the Pittsburg *Post*, under the title "Slide Valves Are the Best," I feel called upon to offer a few lines in defense of the piston valve.

The author of the article is certainly prejudiced against the piston valve, or ignorant, for, in citing certain work done by a slide valve engine, which consisted of hauling a train of 21 cars over a 1 per cent. grade, four miles long, he fails to give the tonnage of this train, and does not so much as offer an opinion as to what a piston valve engine could do under similar conditions.

There seems to be a few motive power men who still doubt the efficiency of the piston valve, due, no doubt, to the impressions received and opinions formed from the earlier type of piston valve engines.

The idea of piston valves is not new among locomotive designers, having been experimented with for the past 25 years, but it was only about three years ago that it was brought out so as to give best results.

The piston valve has received many a

severe criticism which was not its just due. About four years ago when the Brooks Locomotive Works decided to use the piston valve on locomotives carrying 200 pounds of steam and over, there seemed to be an epidemic among all locomotive designers of going to the extreme on the length of stroke or long crank, changing from a 24 or 26-in. stroke to a 30 or 32-in. stroke.

At this time piston valves were applied to locomotives with a 28 or 30-in stroke, the diameter of the driving wheels remaining the same as the 24-in. stroke engines had, and in a number of cases were tested against the 24-in. stroke engines equipped with slide valves. When the performance of the engines regarding speed and fuel consumption were compared, the results showed in favor of the engines with the 24-in. stroke, and the failure of the long stroke engine to meet the results of the short stroke was charged against the piston valve, when it should have been charged to increasing the stroke and increased piston speed resulting from the drivers remaining the same.

About this time designers became possessed with the erroneous idea that a steady blow or blast was the correct thing, and to bring about this condition the piston valve cylinder saddles were designed with large exhaust passages, which acted as expansion chambers for the exhaust so that it became one continuous roar, instead of intermittent, causing a steady blow through the nozzle, which was very wasteful on fuel, also a continual pressure in the exhaust passages, which in turn caused high back pressure in the cylinders. This was proven a serious defect in the working of the engine, and for which the piston valve was not responsible.

During this time the same valve motion was being used for the piston valve as for the slide valve, the former having internal admission and the latter external, resulting in a poor steam distribution as a consequence of indirect movement, the lead increasing fast with short cut-off, causing excessive pre-admission and high compression, all of which was a detriment and charged to the piston valve.

However, with the new four-passage exhaust-cylinder saddles, where the respective cylinders have a separate exhaust passage from each end, we get a short, sharp exhaust and an exhaust passage free from pressure when valve closes, so that the back pressure is reduced to a minimum.

With the direct valve motion we get almost perfect steam distribution, the lead increasing slowly with short cut-off.

With piston valves there is practically no friction, and they will run for two years without renewals or repairs, the valve itself requiring very little oil for the hardest service. In this connection I have never in my four years' experience with piston valves seen a cut valve or bushing.

Engines equipped with slide valves cannot be run successfully any distance with a full throttle on account of valve running dry, cutting valve seat and valve, working hard, springing valve stem, causing a lame engine, and consequently loss of power. However, with a piston valve this does not occur. You may run as long and as far as necessary with a full throttle and the valve will work as free and easy as with a light throttle. You never have a cut valve, and it certainly follows that there is a gain of power over the engine equipped with the slide valve, as none is lost through friction of the valve. Excessive power used to move valve decreases draw-bar pull.

As the piston valve engines are now designed, building them with reasonable length of stroke so as to get economical piston speed, casting cylinders with separate exhaust passages, properly designed exhaust pipe and front end draft arrangement, changing the valve motion to "direct," which gives the best steam distribution on internal admission valves, they will do better work and at less expense than a slide valve engine of the same dimensions.

In conclusion, I will say that the piston valve engines as turned out now by the Brooks Works of the American Locomotive Company should no more be compared with the piston valve engines of three or four years ago than should the air-brake of to-day be compared with that of 20 years ago.

I believe that I have ridden on and noted the work done by all the modern large power that has been built in the last few years, and have given particular attention to heavy power equipped with slide valves, also different types of compounds, and I am satisfied that the piston valve engines, as now constructed, are more powerful on a slow, hard pull and have more speed on account of less back pressure than any other design.

I will call particular attention to the piston valve engines on the Chicago, Rock Island & Pacific Railway; C. C. C. & St. L. Railway and many other roads, both for freight and passenger service; also the last Wisconsin Central passenger engines, the performance of which will bear me out in every claim that I have made for the piston valve.

W. G. Menzel,
Supt. M. P. & C., Wis. Cent. Ry.
Fon du Lac, Wis.

Acetylene Gas Not Poisonous.

Occasionally in your columns you poke fun at the daily press when they attempt to describe technical things, and in the mechanical field you are quite safe in this, but in your January issue your comment: "A chance for the inventor and the ablest chemist," you go a little too far, and are open to more criticism than the daily paper you refer to. You state that common illuminating gas is not poisonous, but you are decidedly in error, as it is well known to be very poisonous, and that the deleterious effects of inhaling such gas are only slightly due to the displacement of free oxygen.

The "inventor and ablest chemist" "did something" a long time ago and produced a gas that is not poisonous—acetylene. That acetylene is not poisonous is well known to gas engineers, and I have several times proved it upon rats. Hold a large rubber tube close to the nose of a rat in a trap and turn on the city gas. Within ten to fifteen seconds the rodent will fall over dead. Take another exactly similar rat and in the same way turn on actelyene gas, and for nearly ten minutes he will not "turn a hair," or make any special effort to get his nose away from the tube. In about fifteen minutes he will become unconscious, then turn off the gas and in another fifteen minutes he will have entirely recovered and will appear none the worst for the experience.

This shows, in a rough way, that city gas is fully sixty times as poisonous as acetylene for the same amount inhaled. Then consider that for the same amount of light only a twentieth the volume of acetylene is used, and the burners and fittings are adapted to pass only that small proportion, then the danger, as compared with city gas is as one is to twelve hundred in favor of acetylene. No one was ever asphyxiated by acetylene, although it is now in quite extensive use. There are no cases on record of suicide by acetylene. If anyone ever tried it he likely gave it up as a bad job and has kept the details to himself.

S. W. Rushmore.
Jersey City, N. J.

Simple vs. Compound Lubrication.

Assuming that any statement found in print is matter open for argument, I venture a few remarks regarding an article which I find in the proceedings of the Traveling Engineers' last meeting, under the head of "The Handling of Compound Engines." On page 259. I find the following, regarding lubrication of the same: "For the lubrication of the cylinders it takes no more oil to lubricate them than the simple engines of the same capacity." "Same capacity" in this instance, I take to mean equal tractive power.

Now, under all known rules of locomotive lubrication I claim that this statement will not bear itself out, from the

fact that what would be economical lubrication of two friction surfaces, one foot square, would be wasteful on surfaces one-half that size, or insufficient for twice that era.

Upon the same subject, RAILWAY AND LOCOMOTIVE ENGINEERING of April, 1899, contains the following:

"Set lubricator so as to feed same as for simple engine of same size and capacity." Again I find on page 302 of your journal these words: "Five drops feed per minute will ordinarily be found sufficient for the largest engines and heaviest service." This statement is of so recent a date that it includes compound as well as simple engines.

Lubrication is the maintaining of a film of oil sufficient to overcome friction between two rubbing or rolling surfaces. Economical lubrication is reached when enough and no more of the lubricant is supplied to do the work required, in diminishing wear and preventing the heating of surfaces.

If we take an allowance of 5 drops per minute as sufficient for cylinder lubrication we must concede that this has been proved sufficient at some time or other. It was sufficient in the bygone days, when the 16x24 in. engines were considered large enough for the work then done. From 3 to 5 drops per minute was the universal feed since the introduction of the lubricator. Those of us who have been long enough in the service can follow the history of lubricator feed by the letters of remembrance from the office of the Superintendent of M. P. or M. M. calling attention to our oil record for the past month, generally ending with the expression, "We will expect improvement in the future."

Then, as now, it was 5 drops per minute. Cylinders have gradually increased, but the drop feed has remained stationary. Let us now examine a few figures and see if they will sustain the argument, based upon the friction surface, passed over by the piston and valve.

In the 16x24 in. engine we find a friction surface in the cylinder of 8.37 sq. ft. In a modern 22x30, we find a friction surface in cylinder of 14.40 sq. ft., and among our modern engines we find many of them equipped with piston valves, which have all the friction elements found within a cylinder of same diameter and in some compound engines with as many as six bearing surfaces, all demanding lubrication from the same source. We will have occasion to compare these valves later on.

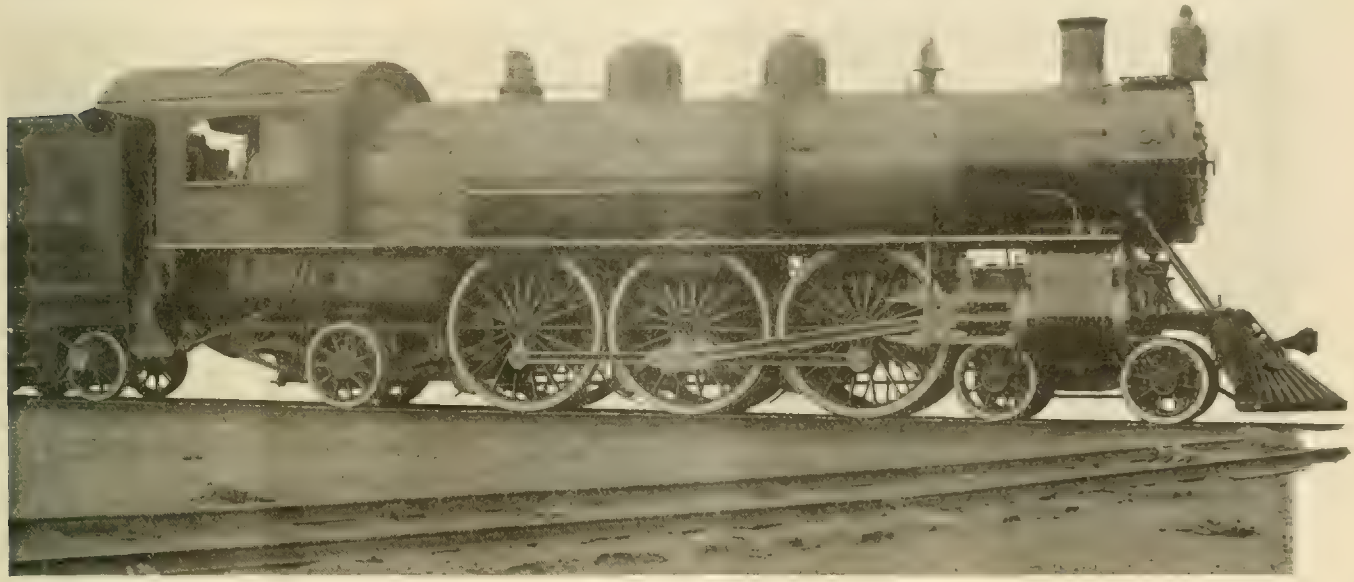
The figures shown for the above-mentioned cylinders would indicate great elasticity of the 5 drops, or an added expense to the shop account by a badly worn cylinder.

Let us put a 61-in. wheel under these two engines and speed them up to 30 miles an hour and see what our drops are doing.

For the 16x24 in. cylinder we have 5,534.74 sq. ft. of friction surface per mile. For the 22x30 we have 10,372.60 sq. ft. This gives us 553.74 sq. ft. for one drop to lubricate in the 16x24, and 1,037.26 sq. ft. in the 22x30, an increase of 87.4 per cent. in friction surface and work, expected of one drop of oil. This is enough to cause one to pause and ask, Are we working in the dark, with our limit of allowance? If 5 drops is the right feed for the one, the other is certainly entitled to better recognition of the work done. In these figures no account has been taken of the work done in steam chests, and these figures as they are, suggest points for study by the engineer while side-tracked one station back of the expected meeting point on account of his slow time up that last hill. They also suggest food for thought by the Superintendent of M. P. while enjoying the comforts of a Pullman seat *en route* to the mountain division, bent on finding out why those new tandem compounds are not doing better work and why they require so many days on the roundhouse pit. I fear that he will find in the end that the schedule must be modified and allowance made according to work done in cylinder at the present time, and not according to work done a number of years ago.

I will now show what we are doing with the compound as against the simple engine. I have selected two engines in actual service, one a simple engine with 22x30 in. cylinders, piston valve 11 in. diameter, 56 in. drivers, 200 pounds pressure on gauge, weight on drivers 130,000, tractive power 41,485 pounds; speeding them 30 miles an hour and feeding 5 drops per minute. Here we have friction surface in cylinder, 14.40 sq. ft.; in valve, 2.87 sq. ft., a total of 17.27 sq. ft.; in one mile we have 10,372.60 sq. ft. in cylinders and 2,070.92 sq. ft. in chests; total, 12,443.52 sq. ft. per mile, which gives us 1,244.35 sq. ft. for each drop of oil to lubricate.

For a compound I have taken a 17 and 28x32 in. cylinder engine, 57 in. drivers, 210 pounds steam pressure, weight on drivers 176,000, tractive power 43,000; piston values, 11 in.; speed and feed same as before. Results as follows: 17 in. cylinder, 11,866 sq. ft. friction surface, 28 in. cylinder, 19.54 sq. ft.; valves, 8.635 sq. ft.; a total of 40.03 sq. ft., as against 17.27 sq. feet. in the simple engine, or an increase of 22.77 sq. ft. or 1.317 per cent. In one mile run we have in the 17 in. cylinder 8,396.85 sq. ft.; in the 28 in. cylinder 13,827.28 sq. ft., and in valves, 6,110.47 sq. ft., a total of 28.334.61



CHICAGO & ALTON "PACIFIC" TYPE, EXPRESS ENGINE.

Description on page 120.

sq. ft., or 2,833.46 sq. ft. per drop of oil. This amounts to an increase in work expected of each drop of oil over the 22x30 of 1,589.11 sq. ft., or equal to 1.27 per cent. The difference in percentages of increase of 1.317 per cent. and 1.27 per cent. arises from the variation of the diameters of drivers, the variation in both instances equalling .04 per cent. I have made no allowance for the variation in dimensions of steam passages, those in the compound containing much greater area than those in simple engine, and all retaining a portion of the oil intended for lubrication. Valve oil in service, from the time it leaves the choke plug at lubricator until taken up by the steam is in the form of an emulsion. The steam at a temperature of nearly 400, becomes saturated with this oil in suspension, only a few degrees below the vaporizing point of the oil; steam enters the cylinder and comes in contact with a surface cooled by the expansion and exhaust of the previous stroke; condensation takes place and a portion of the oil thus held in the steam is deposited upon the walls of the cylinder. Those portions which contain the greater thickness of metal and consequently retain the greater amount of heat, receive the lesser portion of oil, notably the upper part of cylinder and the piston head. A portion of this oil must necessarily pass away in the drip from cylinder cocks and other avenues of escaping steam, so that we have only a portion of our drop for actual service, how much I know not. I cannot see where, according to the figures shown, we have any to spare. The temperature of steam is governed by the pressure under which it is used, and as compounding has been adopted as a remedy for cylinder condensation, we note that as steam is exhausted from the high pressure cylinder of a compound at a higher pressure and consequently with greater temperature than in the simple engine. It follows that less condensation takes place in the high pressure cylinder, hence less oil is left on the walls of this cylinder. The greater part of the oil passes over into the low pressure cylinder, and a portion of it passes out at the exhaust. This can be readily shown by examining the conditions which exist in any power plant using a condensing engine.

As a help to the fuller consideration of this comparison let me point out that in the 22x30 in. engine, at an 8 in. cut-off, we have 1,260.56 cu. ft. of steam at boiler pressure used per mile, expanded to 4,754.11 cu. ft., which gives us 475 cu. ft. of steam to be saturated by one drop of oil, with which to lubricate 1,244.50 sq. ft. of surface.

In the compound we have 927 cu. ft. of steam at boiler pressure, expanded to 10,946.10 cu. ft., to be saturated by one drop of oil, and expected to lubricate 2,222.41 sq. ft. of surface.

These are hard, cold facts, and not idle curiosities. Is it any wonder that we hear of broken packing rings and cut cylinders and valves; bushings put in cylinders less than one year old? Is it any wonder that valve motion wears out in a short time, blades and stems buckle and engines go lame? I say no, it is not, and until we become educated up to the fact that increased friction surface means more oil in proportion, there remains a long array of ills which the modern locomotive is heir to, which can only be cured by oil in alopathic doses. More oil on the road means less expense in the back shop, and more dollars saved with which to buy new engines. When railroad companies come fully to realize this point the expense of maintenance, and not the thousand mile cost of oil, will become the ruling fad. Yours,

C. B. SOPPER.

Denver, Col.

MEETING OF BOARD OF ENGLISH RAILWAY DIRECTORS

An English Railway Board.

The cartoon to which the above caption belongs is reproduced from *Truth*. It is a graphic story that tells about the braking forces which have kept British railways untouched by innovations and apart from all ideas of progress. The cartoon is accompanied by the following rhymed prose:

How strange are the ways of the English! A railway, of all things, is that which requireth the men who control it to know what it is they are at. Great energy surely it needeth in those who its doings direct; youth, ardor, initiative, impulse, are what in its board we expect. But lo! when I looked at the table round which its directorate drew, 'twas a posse of fussy old parties that met my inquisitive view. Most were not only aged, but feeble; some deaf; and some not far from blind; and to anything rather than business, so far as I noticed, inclined. Some had come in bath-chairs, some on crutches; whilst some had ear-trumpets to use before they could hear their friends' gossip, or even discuss the day's news. So 'twas no easy task for the chairman, advised by officials of note, to induce his loquacious directors themselves to their task to devote. And when they *did* grapple with questions, or take at the minutes a look, it was always, I noted, a sort of old fogyish view that they took. Did the public want faster expresses? In a carping and querulous tone the directors cried, "Bother the public! Why can't they just leave well alone?" Did inventors suggest new inventions—new engines, new coaches? "Oh, dear!" sighed the portly old men round the table. "Why, why with our line interfere? Our rate's fast enough for our comfort; it's the same that we traveled when lads. What's the good, then, of these innovations? We don't want these new fangled fads!"

Old-Time Railroad Reminiscences.

Editors: Many of the locomotive engineers at present employed in that calling are not compelled to strenuously rack their brain to recall some incident in their career when at a most unexpected moment some real or imaginary obstruction has loomed up in their immediate front, or something went wrong, which resulted in their hair assuming a more or less perpendicular position from the normal it usually occupies.

During my days as a C., B. & Q. en-

gineer, I occasionally was subjected to annoyances of this character, though, as a rule, the scarce did not fully materialize until after the incident was closed, but I well remember an experience which happened one night quite a number of years ago, when the terror came upon me in an unguarded moment, causing my hat to rest on top of my vertically standing hirsute adornment as etherealy as a bandanna handkerchief on the summit of a briar bush.

At the time the incident occurred, I was running the "Winona" No. 49, on the night express, known as the Atlantic and Pacific, and from the fact that the engine was small, the train heavy and and the grades steep, in approaching the latter the highest possible speed was attained, regardless of the time-card rule "no passenger train must exceed a speed of one mile in two minutes," to offset the time sure to be lost in climbing the hill.

Now, to digress a little, I would say that the previous night, on our way west, the operator at Osceola had related to us a choice morsel of news, which shortly prior to our arrival had passed over the wire, to the effect that about sunset the evening before a Chicago, Rock Island & Pacific train had been held up at Avoca by the James brothers, who at the time, were actively engaged in conducting financial collections from the unwary in States adjoining the Mississippi River, the engineer killed and the express car looted of a considerable sum of money.

The freebooters, when last seen, had mounted their horses and started in a southerly direction, which would indicate their crossing our track, some forty miles south of the scene of action, about the same time in the early morning that we would have occasion to use it. However, we pulled out and reached our destination without molestation.

On our return trip, it was made known to me before leaving that a large amount of money was in the express car, such notice usually being given to the engineer in those days on our road; also a number of well-armed guards, the practice being then, as now, to lock the stable doors after the other fellow's horse had been stolen, but this did not relieve my mind, as the hold-up at Avoca had been accomplished by removing the fish plates and spikes and, with a rope through the bolt holes in the rail, shifting it inwardly immediately ahead of the pilot, which ditched the engine and forward portion of the train.

The shades of night were falling as we started on our journey, and in the course of an hour's run, it had grown intensely dark and forbidding. No stars peered through the dense clouds, no lamps designated the location and position of switch rails, and few friendly lights sparkled from depots and houses adjoining the track to relieve the monotony, which every engineer experiences at such time, as we rapidly passed over the rails, but everything moved along serenely until Tyrone had been left behind.

From this point to the foot of Albia hill, some six miles, the track slightly descended, following a narrow, heavily wooded valley, with no signs of human habitation or life on either side.

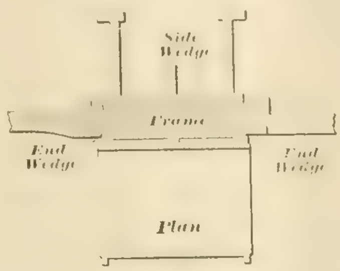
Passing Tyrone at a good speed, I let the 49 out for her run at the hill. As we rapidly passed down the valley, the time being about midnight, I was seated with my head out of the cab window, deeply wrapped in thoughts of the previous night's robbery and depicting in my mind the inviting locality we were then in, for a hold up, when suddenly, as we neared the foot of the grade, two loud reports, sharp as the crack of a rifle, resounded, each followed by a blinding flash. I jumped to my feet, and nearly simultaneous were the movements to shut off steam, apply the straight air brakes and the erection of my hair, the latter, possibly, leading the other motions —I, meantime, imagining those woods full of the James brothers' coterie. By the time we had slowed down to perhaps twenty miles per hour, my deserted senses had again collected, and I released the brakes, the fireman came down from the top of the cab, and I pulled out for the hill.

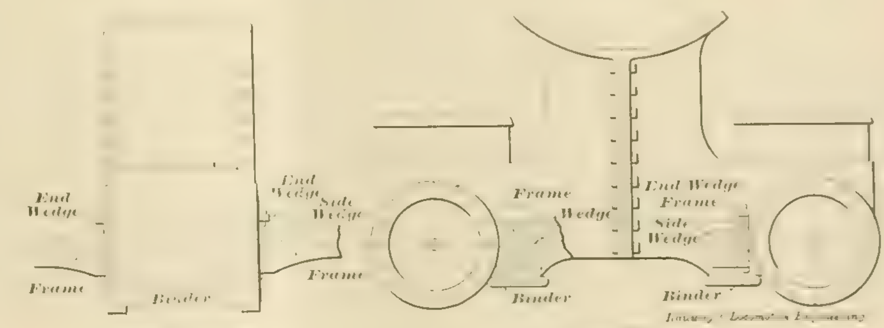
As the reader may surmise, it was a false alarm, so far as my suspicions were concerned, though one which was encountered at that particular point not infrequently. Freight train No. 12 was scheduled in Albia, at the summit of the grade, slightly ahead of us, and it being nothing unusual for that train to stall and double, when such occurred two torpedoes were placed on the track as a cautionary signal, but from which, with my mind engrossed with train robbers, dismal surroundings and a favorable location for gentlemen of the Dick Turpin stamp to ply their vocation, I received a mental shaking up that left an impress from which I did not fully recover for a considerable time. S. J. KIDDER.

Boltless Cylinder and Frame Connection.

The Philadelphia & Reading people have been using, for some little time, a cylinder and frame connection, in which bolts may be said to be "conspicuous by their absence." The design was made and patented by Mr. S. F. Prince, Jr., superintendent of motive power of the road. That portion of the frame to which the cylinder is attached is made very nearly twice as deep as it is wide, and it is considerably deeper than the rest of the frame front.

The portion of the cylinder saddle which fits over the frame is planed out parallel and the frame is straight on one side and tapers at the other, so as to accommodate the large side wedge which lies beside it, as shown in our illustration.





Side Elevation *Front Elevation*

BOLTLESS CYLINDER FASTENING BY E. G. PRINCE, JR.

This frame and wedge cavity in the saddle has an opening on the under side, so that the cylinder casting may be passed over the frame set in its normal position. When this operation has been accomplished a binder, lipped-up on each side of the opening and carried along the full length of the cylinder casting, is closely fitted up and bolted to place. The frame is thus practically loosely enclosed in a box with rigid walls, of which the binder forms the bottom and the three other sides are the frame seat in the cylinder casting. A hammered iron wedge the full depth of the frame is then put in place from the front and driven home. Two small end wedges are placed in a vertical position at the front and back of the cylinder casting and driven home. All the wedges are secured by bolts. The two small end ones have each a bolt passing through a lug forged on the top and these bolts are tapped into the frame. The main wedge is held by one bolt with head countersunk in the frame so that there

is no possibility of a slip in any direction.

This method has given entire satisfaction and has the advantage of not weakening the frames with bolt holes. All the work, with the exception of the bolt hole through frame and main wedge, can be done on machines before any of the parts are assembled. A pair of cylinders can be removed when necessary, in a surprisingly short space of time. There is no possibility of the cylinders "working" on the frames, if the fitting up has been properly done, and this boltless cylinder and frame connection is in its way as up-to-date as the horseless carriage or the wireless telegraph.

Laboratory Locomotive for Cornell University.

You will be glad to learn that the Baldwin Locomotive Works has recently offered to present to the Railway School of Sibley College a laboratory locomotive of the Vauclain de Glehn type, especially built to plans to be agreed upon by the Baldwin Works and myself. The gift will not be consummated until a building and a testing machine are provided for. I did not intend to have the matter get to the public until we saw our way definitely clear for the providing of the necessary equipment on which to mount the locomotive, but the knowledge of the offer from the Baldwin Works leaked out to the daily papers, and to prevent any misinformation is the purpose of the present letter.

The locomotive will be a four-cylinder balanced compound like the engine built for the Plant system, but with four truck wheels and four driving wheels. The boiler will be designed to carry up to 300 pounds gauge pressure. When the locomotive is run at this pressure the entire weight of the locomotive can be thrown upon the driving wheels by means of a pneumatic cylinder at the rear connected to an anchor in the foundation. When this traction increasor is not used the engine will run at 200 pounds gauge pressure. It is intended to be very easily convertible into a perfectly balanced two-cylinder simple engine by the removal of the two high pressure cylinder bushings and a change in the valves. The details of the engine have not as yet been worked out, but are being figured. No work at all has as yet been done on the designing of a testing machine, awaiting the development of the design of the locomotive, its weight, power, wheel base, etc.

When the plans of testing machine and building are completed and estimates available, we shall call upon the friends of Cornell for assistance.

I would add that every fall a series of locomotive tests is regularly carried on for our railway seniors through the kindness of the Delaware, Lackawanna & Western Railroad upon that portion of the road which comes into Ithaca. I have named these "Instruction Tests," as they are primarily intended to instruct our railway students in the methods of locomotive testing on the road. Each cylinder has two indicators with short, straight pipes, the indicator reducing rig is of the pendulum or similar triangle type, geometrically perfect, practically rigid and light and entirely satisfactory. The coal is weighed into bags, water is metered between tank and injector, hydraulic dynamometer draw bar used, steam chest diagrams taken, we use steam-dryness calorimeters in dome and steam chest, smoke box, vacuum gauge, take the smoke box temperature, use the Boyer speed recorder, driver stroke counter and recorder, air pump stroke counter and recorder; and we make the various calibrations of dynamometer, tank, water meter, boiler, blower, safety valve, air pump, valve setting, cylinder clearances, etc. The students themselves do the work of rigging up the locomotive for test and stripping it ready for replacing in its regular service. It is not intended that these annual instruction tests should be omitted after we have a laboratory locomotive. Toward the end of the senior year a number of our railway seniors and graduates usually make thesis tests of locomotives for different railroads in the East. The students are in full responsible charge without assistance from the faculty. The coming spring, among other tests of railway equipment, there will be one of the Baltimore & Ohio locomotives upon the Royal Blue limited train between Philadelphia and Washington.

H. Wade Hibbard,
Prof. of Mech'l Eng'g of Railways.

Fast Passenger Power for the Alton.

(Illustrated on page 117.)

The Chicago & Alton have recently purchased some 4-6-2 fast passenger engines from the Baldwin Works. These are very powerful machines, having simple cylinder 22x28 in. On one engine the drivers are 73 in. diameter, and on two others they are 80 in. The tractive weight is 141,700 pounds, and the boiler pressure is 220 pounds. From these figures it follows that the calculated tractive effort which can be exerted by the engine with the 73 in. drivers is about 34,700 pounds, and the weight on drivers divided by the tractive effort gives 4.08 as the ratio of tractive power to adhesive weight.

The first engine with this wheel arrangement built at the Baldwin Locomotive Works was in 1897, for the Millars Karri & Jarrah Forests Co., Ltd. They were used on a Western Australian road of 3 ft. 6 in. gauge. A similar engine as far as wheel arrangement goes was built S. Morris, and which was illustrated in for the C. & O. from designs by Mr. W. our October 1902 issue. An engine of this 4-6-2 type had been built for the C., M. & St. P. in 1895 by what was then the Schenectady Locomotive Works.

The heating surface in the boilers of these engines amounts to 4,078 sq. ft.; this equals an area represented by about 61 1-2 ft. length of a country road which measures 1 chain, of 66 ft. wide. The grate area is 54 sq. ft. The boiler is of the straight top wide fire-box variety, measuring 70 in. in diameter. The Vauclain butt joint, with double triangular welt, is used, having 96 per cent. of the strength of a solid sheet. This form of boiler seam was illustrated in our August 1902 issue. Expansion or flexible stay bolts are used in the throat sheet, which is short and slopes at a considerable angle.

As stated above, the diameter of the driving wheels on one engine is 73 in., and on another 80 in. This was done for the purpose of determining from actual service test, which size would prove best adapted to prevailing conditions on the road. The locomotives are equipped with the Rushton radial swing side-bearing truck under the overhanging fire-box. This makes it possible to pass without difficulty round curves of 14 degrees. The Player traction increaser is also a feature of the construction of the engine with the smaller driving wheels. This device operates so as to practically shorten the spring hanger at the back of the rear drivers and the front of the leading drivers, thus placing greater adhesive weight on the six driving wheels. Two W. A. B. cylinders, accomplish this result. It is estimated that when the traction increaser is in use about 15,000 lbs. is added to the weight on drivers.

The motion of the engine is indirect, the transmission bar being arched over the leading driving axle, with bolt and filler underneath. Piston valves are used. The cab is lighted in the ordinary way with ample window for the engineer, and above in the slooping roof there is what may be called a dormer window on each side. The tender carries 9 tons of coal and 8,400 gallons of water, and is built up high after the manner of many of the Alton passenger tenders. This locomotive furnishes a good example of a modern high-speed passenger engine, and includes many interesting features. To use the ordinary language of the road, these engines will "pull passenger" between Chicago and St. Louis.

Some of the principal dimensions are given below:

Cylinder, 22 in. x 28 in.

Boiler—Dia., 70 in.; thick. of sheets, 11/16 in.; 23/32 in. and 3/4 in.; working pres. 220 lbs.; staying, crown bar, 5 1/4 x 6 in.

Firebox—Length, 108 in., width, 72¼ in., depth, front 75⅝ in.; back, 64⅛ in; thick. of sheets, sides, ⅜ in.; back, ⅜ in; crown, ⅜ in.; tube, ⅝ in.; water space, front 4½ in; sides, 3½ in; back, 3½ in

Tubes—Material, iron gauge No. 11; Number 328, dia., 2¼ in.; length, 20 ft

Heating Surface—Firebox, 202 sq. ft., tubes, 3,848 sq. ft.; firebrick tubes, 27 sq. ft.; total, 4,078 sq. ft.; grate area, 54 sq. ft.

Eng. truck wheels (bck.)—Dia., 42 in; jour., 8x12 in

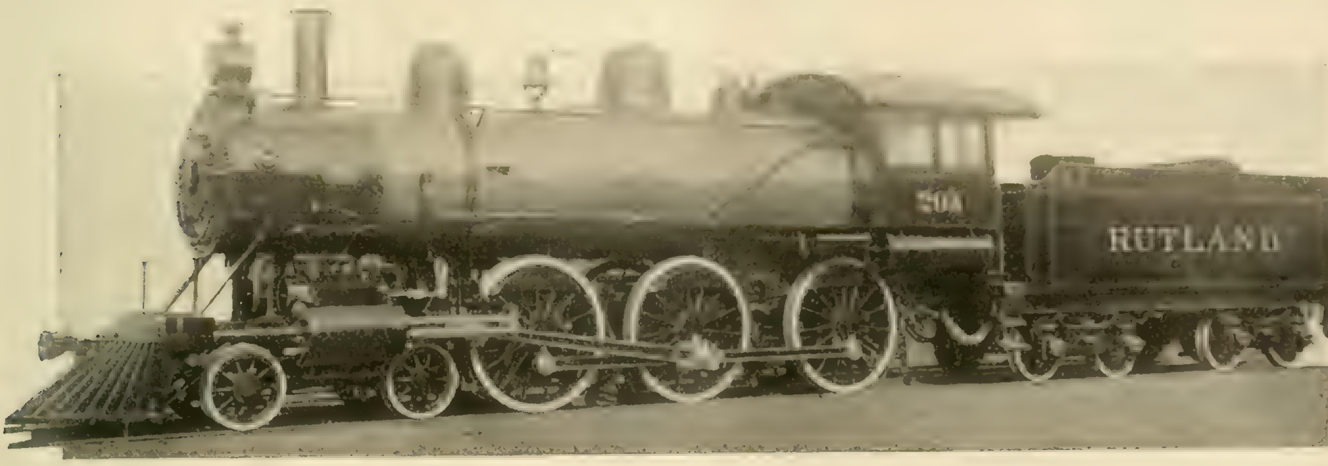
Wheel base—Rigid, 13 ft. 9 in., total eng., 32 ft. 8 in total eng. and tender, 62 ft.

Weight—On driving wheels, 141 700 lbs.; on truck, front, 36,300 lbs.; on truck, back, 41,500 lbs.; total engine, 21,900 lbs.

Tank—Capacity, cool, 9 tons; water, 8,400 gals.

Ten-Wheel Engine for the Rutland.

The Manchester shops of the American Locomotive Company have recently supplied some passenger engines to the Rutland Railroad. These are of the type designated by the builders as 460-155, which, when interpreted as it is on another page of this issue, settles the wheel arrangement, the total weight and fact that the engine is simple.



TEN WHEEL PASSENGER ENGINE FOR THE RUTLAND RAILROAD

The cylinders are 20x26 in., the diameter of the drivers are 69 in., they carry 118,000 pounds and the working pressure is 200 pounds. The theoretical tractive effort which this machine can exert is about 25,600 pounds. The ratio of adhesive weight to tractive power is 4.6. The valve motion here is direct, as the rocker arms are both turned down and the transmission bar passes up over the axle of the leading driver. The springs are all underhung, carried by hangers, which are hooked over and rest on top of the boxes. Safety hangers surround both equalizers.

The boiler is one of the extension wagon-top style and carries the dome on the first circular sheet, which is 72 in. in diameter; the gusset sheet reduces the diameter of the boiler to 61 in. at the front end. The total heating surface is 2,446 sq. ft., and there are 30 sq. ft. of grate surface. The "Perfection" smoke consumers are used on these engines.

Some of the more important dimensions are subjoined:

DIMENSIONS.

Weight in working order [illegible] lbs.

Weight on drivers, 118,000 lbs.

Weight engine and tender in working order 271,400 lbs.

Wheel base, driving, 14 ft. 10 in.; rigid, 14 ft. 10 in.

Wheel base, total, 25 ft. 10 in.

Wheel base, total, engine and tender, 56 ft. 3 in.

VALVES.

Valves, piston type, inside admission.

Greatest travel 6 in.; outside lap, 1 in.

Inside lap, ⅛ in. clearance. Lead in full gear, 0 in.

WHEELS, ETC.

Dia. and length of driving journals, 9 in. x 11 in.

Engine truck, journals, 6 in. dia. x 11 in.

BOILER.

Thickness of plates in barrel and outside of fire box [illegible] and [illegible] in.

Firebox, length, 108 in.; wdh., 41 in.; depth, front, 76½ in.; back, 64½ in.; plates, thickness, sides, 5/16 in.; back, 5/16 in.; crown, ⅜ in.; tube sheet, ½ in.; water space, 4½ and 5 in. front, 3½ and 4 in. sides, 3½ and 4½ in. back.

Tubes, iron, No. 11; gauge, number, 312; dia., 2 in. Length over tube sheets, 168 in.

Heating surface, tubes, 2,273.47 sq. ft.

Heating surface, fire box, 172.85 sq. ft.

Heating surface, total, 2,446.32 sq. in.

Smoke stack, top above rail, 14 ft. 7¾ in.

TENDER.

Weight, empty, 47,000 lbs.

Journals, dia. and length, 5 in. dia. x [illegible] in.

Wheel base, 18 ft. 9 in; frame, 10 in. steel channels.

Water capacity, 5,900 U. S. gallons.

Coal capacity, 10 tons

Brevity Is the Soul of Wit.

A certain chief clerk to a general superintendent regarded his superior as a model letter-writer, brevity being the characteristic most admired. The clerk let it be widely known that many of the lesser officials might, in his opinion, reduce the length of their letters, and follow the lead of the G. S. This stickler for concise English persuaded his chief, in a moment of weakness brought on by flattery, to permit the issuing of an advisory circular in which the value of condensed correspondence was extolled, and it happened that the general foreman was the first transgressor. It seems the M. M. had requested and obtained permission for his general foreman to examine and report upon the merits of a certain device used on a neighboring road. The report was to describe the make-up and operation of the device with a statement of first and operating cost, and two sheets of the company's stationery were used in carrying out instructions. The G. S. put a few words on the turn-down corner of the correspondence, when it reached him, and the chief clerk regarded it as simply perfect. The G. S. had written, "We will not use this." The foreman was subsequently "tackled" by the clerk, about the great length of his letter, and he replied something after this manner: "See here, young man, we all know that you wrote out that circular for the G. S. to sign, headed, 'Brief and Businesslike Correspondence,' in which such expressions as 'laconic phraseology' and 'short Anglo-Saxon words' are used. If I wasn't afraid of stirring up trouble I'd out-do you and the G. S. at one go. I could fix the circular up in one word, just to show how really brief I could be, and if you could boil down, distill, wring out or extract the quintessence of absolute truth about it, more fully, more concisely, or with more deadly accuracy, I'd give you my month's pay. I'd just write 'Bosh' across the face of that circular, and so express the universal opinion of your efforts to reduce correspondence. It's easy enough to say yes or no to a long statement, but it isn't easy to make a long statement as short as yes and no."

The business of the late William C. Baker, which is now managed by his daughter, Miss C. A. Baker, has been unusually prosperous this season. In addition to supplying a great many heaters for steam railways, they have worked into a good business of heating street cars, which is rapidly increasing. Miss Baker is a most generous employer of labor and is extremely popular with her people.

It is a poor heart that never rejoices; and our hearts are not poor—no!—*Mr. Pecksniff.*

Railway and Locomotive Engineering

A Practical Journal of Railway Motive Power and Rolling Stock.

Published monthly by

ANGUS SINCLAIR CO.,

174 Broadway, New York.

Telephone, 984 Cortlandt.
Cable Address, "Loceng," N. Y.
Glasgow, "Locauto."

Business Department:
ANGUS SINCLAIR, President.
FRED M. NELLIS, Vice President.
JAMES R. PATERSON, Secretary.

Editorial Department:
ANGUS SINCLAIR, Editor.
F. M. NELLIS, GEO. S. HODGINS, JOS. A. BAKER, Associate Editors.

Advertising Department:
Eastern Representative, S. I. CARPENTER, 170 Summer St., Boston, Mass.
Western Representative—J. A. BAKER, 1204 Monadnock Block, Chicago, Ill.

British Representative:
THE LOCOMOTIVE PUBLISHING CO., Ltd. 102a Charing Cross Rd., W. C., London.

Glasgow Representative:
A. F. SINCLAIR, 7 Walmer Terrace, Ibrox, Glasgow.

SUBSCRIPTION PRICE.

$2.00 per year, $1.00 for six months, postage paid to the United States, Canada and Mexico. For other parts of the world, $2.50, or ten shillings. Single copies, 20 cents. Remit by Express Money Order, Draft, Post Office Order or Registered Letter.

Mailing address can be changed as often as necessary—always give old and new address, and if you subscribed in a club state who got it up.

Please give prompt notice when your paper fails to reach you properly.

Entered at Post Office, New York, as Second-class mail matter.

For Sale by Newsdealers Everywhere.

To Prevent Boiler Explosions.

Within one period of ten days last month we received mention of seven explosions of locomotive boilers. Several of them started with the firebox crown sheet coming down which indicated shortness of water, but the others were reported as mysterious occurrences. It nearly always happens that when the business of railroads is particularly active, boiler accidents are numerous. Reasoning between cause and effect, we conclude that the eternal inspection vigilance which keeps boilers free from serious accidents is frequently relaxed at such times and that men are put in charge of locomotives who are not properly impressed with the necessity for keeping the crown sheet covered with water.

Only a few years ago the first move in the line of investigation to find the probable cause of a boiler explosion was to make tests of the material. Only too often the material was found defective, but that is not the case nowadays. With modern specifications and modern steel plate there is always sufficient strength if deterioration has not been permitted to break it down or mistakes have not been made about the high pressure to be provided for.

Of late years there has been a tendency to increase the boiler pressure from 140 to 200 pounds or thereabout, and in very many cases the strength necessary to safely resist the augmented pressure has not been provided. The increase of pressure has brought increase of danger, yet the men responsible for the safety of boilers are often too apathetic to find out the great danger that exists. Hundreds of men are working all the time over a volcano in the shape of a weak boiler pressed beyond the safe limit, and they acquire the familiarity which brings contempt of danger. It is so human to become reckless of danger that good government ought to step in and enforce rules of safety, even although the parties whose life and limbs are most seriously at stake object to have measures to promote safety carried out. The Interstate Commerce Commission has labored persistently with excellent results to reduce the dangers incurred by trainmen and others, and we think it high time that the same board was given protecting power over dangerous boilers, or, rather, over boilers that are likely to become dangerous through natural deterioration that has been neglected.

When a disastrous explosion of a locomotive boiler happens the blame is thrown upon the engineer in charge if possible, and failing in that, upon the master mechanic or the foreman immediately responsible for the systematic inspection of the boiler; but all these personages are mere buffers to prevent the shocks of the real responsibility from flying upward to the real culprits. The demand to keep the motive power working at any cost is what induces the underlings to risk the neglect of inspection. The prevailing sentiment among directors is "move freight and passengers at all hazards. Do the work safely if practicable, but move it."

Laws ought to be established that would make the systematic inspection of boilers imperative periodically, and the head of the mechanical department should be held responsible for neglect of the very important work. He, of course, would pass upward the responsibility for accidents.

Some railroad companies have made contracts with boiler insurance companies to assume the responsibility of keeping their boilers safe. Where that is done everybody interested may rest assured that no boiler is at work with scores of stay bolts broken, which is a very common condition where systematic inspection is neglected. Hiring the services of an insurance company to keep the boilers safe is better than depending upon the overworked foreman boilermaker; but a still better method could easily be arranged to be carried out by powers whose actions would be backed by national authority.

The United States Government holds supervision of marine boilers, and it is generally conceded that this system of control is right and proper. On the same principle it would be a small extension of government authority to put the boilers of all locomotives engaged in interstate commerce under the control of the Interstate Commerce Commission. Many people supposed, when Congress put power in the hands of the Interstate Commerce Commission, to compel railroad companies to equip their cars with safety appliances, that the law would remain a dead letter; but it was enforced; and many people are alive to-day enjoying the pursuit of happiness who would be in their graves had the law relating to the compulsory use of safety appliances been permitted to fall into desuetude. The extension of the law to include locomotive boilers would be one of the most humane acts that Congress could possibly put in force.

There is no rational reason why the boilers of locomotives engaged in interstate commerce should be exempted from government inspection and supervision when boilers of steamers are subject to this form of control. The lives of people traveling on railroads are certainly as valuable as the lives of those who travel by water. The practice of requiring marine boilers to be systematically inspected by competent boiler experts has proved one of the best safeguards of human life ever introduced. An explosion of a marine boiler is a remarkably rare occurrence, due directly to proper periodical inspection. Travelers by land ought to enjoy similar immunity from accidents. The same treatment will produce like results.

A Word for the Resident Inspector in Prosperous Times.

Macaulay tells us in his magnificent essay on Warren Hastings that when that statesman was Governor-General of India the directors of the East India Company, for whom he was acting as the highest executive officer, used to send instructions in which were many just and humane sentiments, but that the sum of almost all the instructions that Hastings ever received from home were "Govern leniently and send more money; practice strict justice and moderation toward neighboring powers and send more money. Be the father and the oppressor of the people; be just and unjust, moderate and rapacious." We may in these days hold up our hands in holy horror or feel surprised and indignant at what we read, but looked at calmly and dispassionately, are these instructions, delivered at various times during a period of years and skilfully boiled down by Macaulay to a single sentence —are they any more impossible of fulfilment than some of those which are given

at the present time to many an inspector or even foreman in some of our large manufacturing establishments? The instructions when boiled down sometimes resemble the words, "Detect and stop all bad work in the shop, but do not restrict output. Be vigilant above all things to catch defects, but do not interfere with output." This impossible line of conduct is particularly likely to be what is marked out for an inspector belonging to a large manufacturing concern during rush times. An inspector sent from the buying company is, of course, in a very different situation. We do not say that instructions are thus put forth with all their absurdity stamped upon them. The directors of the East India Company had probably no idea of what they were doing or of how posterity, guided by the eminent historian, would view their actions. The fact, however, remains that output generally determines revenue, and the modern Warren Hastings in the shop is often virtually asked to "practice strict justice and send more money."

We once heard of a resident inspector in a large car building establishment who stopped a certain number of cars one day for various cases of defective workmanship. The man in charge of the shop said: "Can't you let them go, it will stick me badly in output if you don't?" The inspector replied: "As far as I am personally concerned—yes, and yes all the more if the defects pointed out to-day do not appear to-morrow or the next day since you have had warning, but you can't guarantee to reform all those practices without making the delinquents do the work over again, and if they work properly they won't turn out as much as they are doing now." We are afraid the output department ultimately triumphed, though we believe the inspector did not cave in.

The late Salmon P. Chase once said, when there were any number of arguments being put forward by politicians to show how the government might best resume specie payments after the war—"the way to resume is to resume!" and applying that idea now, the way to do good work is to do good and not to talk to the inspector about it. There are some men who seem to think that by carefully explaining to an inspector how awkward it would be, and how much time it would consume, to cut out, say, a loose rivet in an out-of-the-way corner, that the explanation somehow makes the rivet tight, and the inspector ought to be thoroughly satisfied. If the unreasonable inspector has any sort of hazy idea that the ability to drive a tight rivet should reside in a man's arms and not in his mouth, he will probably remain unsatisfied, even if the rivet is most awkwardly paced. The whole thing boiled down again amounts to "Insist on absolutely perfect workmanship every time, but, for goodness' sake, don't hamper output in any way."

It is just possible that buyers may be in some way morally responsible for part of this output craze with which the resident inspector has to fight. A great many railroads renew their equipment by fits and starts, and though they make maintenance a daily study and insist upon it being properly carried on by the rank and file. They often seem to lose sight of the fact that at the very best only a definite percentage of their equipment can be maintained. Cars and engines are bound eventually to get beyond the economical repair point, and on the very best roads in the land, every year sees some equipment ready for the scrap heap. Those roads are wise who know approximately the yearly percentage of loss and make it good by the systematic introduction of new stock. It is the roads which order equipment by fits and starts which insist most strongly on "time" deliveries, and the "output" department of the manufacturing establishments is apt to feel that the resident inspector is, under all circumstances, a man who ought metaphorically to retire to a very considerable distance and assume an easy and comfortable posture in an armchair. The resident inspector, if he gets anything like a fair chance, is often very useful safety appliance, and where he is efficient he is generally a reputation preserver for his firm.

The Westfield Disaster.

On the evening of January 27 an express train on the Central Railroad of New Jersey ran into the rear of a delayed local train at Westfield, N. J., about 20 miles south of New York. Several of the cars were badly smashed and the wreck took fire, so that between the collision and the fire 23 persons lost their lives and many others were injured. That part of the Central Railroad of New Jersey is operated under an automatic block signal system, which was in perfect order on the night of the accident. The engineer, James H. Davis, passed three danger signals before he struck the local train. He was having a little difficulty with the injector, and steam was escaping from a broken steam chest, which obscured the view ahead somewhat. The injector and the steam distracted his attention for the few seconds that a train running 60 or 70 miles an hour takes to pass over the distance that stationary signals are within the scope of vision, and the trains were almost together before the danger was perceived. The engineer, who died of injuries received in the collision, is justly held responsible for the accident; but those who blame him ought to try and put themselves in his place for one short minute, in which the whole of the tragedy was prepared by the engineer permitting his mind to be concentrated upon one duty that for the time seemed of supreme importance.

As New York is the headquarters of yellow journalism of the United States, that class of publication outdid itself in extravagant accounts of the accident and of ridiculous recommendations of how to prevent train collisions. The engine that caused the accident was of the Wootten type, which has the cab on top of the boiler. The yellow journals called this a camel-back boiler engine, and all of them demanded that laws be passed immediately requiring that three men must be employed on these engines. Another demand made was for laws compelling railroad companies to equip their lines with automatic appliances that will shut off steam and apply the brakes without the action of the engineer in case of impending danger.

Judging from our own experience in cabs of Wootten locomotives, and from the views of engineers whose business it is to handle those engines daily, we do not think that safety would be increased by having two men in the cab. Railroad companies established a rule prohibiting others except the engineer and fireman from riding on locomotives, principally because the visiting distracted the engineman's attention from his duties with dangerous consequences. The same objections hold to putting an idle man as a regular thing in the cab.

The appliances invented to stop trains automatically are at present like nearly all emergency appliances, very liable to be out of order when the rare emergency arrives. A railway appliance not in regular use has been found by experience to be an extra source of danger.

Railway trains will never be operated without some danger, and we fail to perceive that anything will ever be invented which will dispense with the care, intelligence and judgment of the human direction. The public may wisely demand that railroad companies shall use the most approved appliances for promoting safety—it is the right and privilege of the people to demand the employment of reliable, skilful and efficient employees, but they have no right to force upon transportation companies methods or appliances that do not bear the stamp of reliable practicability.

When railroad companies employ reliable and efficiently trained men, it is their duty to see that their employees are kept keyed up to a sound tone of efficiency, a duty which, there is reason to believe, is lamentably neglected. The number of rear-end collisions that have happened lately, in presence of automatic block signals, leads to the inference that the engineers have fallen into the habit of taking chances in running past signals that stand at danger. Men responsible for making time with heavy

fast trains are under strong temptation to violate a rule which will save a few seconds, but the habitual violation of the rule to stop before a danger signal will eventually lead to disaster. When rules are habitually violated the officials are to blame.

Having equipped their property with the most approved safety appliances, and having employed efficient help, which is properly disciplined, a railroad company has performed its whole duty to the traveling public. Accidents intervening against those precautions are inevitable and unavoidable.

Disregarding Signals.

A curious circumstance has often been observed when a highly civilized nation is engaged in war with savage tribes. The curious circumstance is that what will put a civilized soldier *hors de combat* does not necessarily check the onrush of the savage. In the Zulu war, sable warriors were frequently found whose bodies had been penetrated by bullets, and who, though mortally wounded, were, nevertheless, able to continue the charge, and for a certain length of time, to fight with their enemies at close quarters. It was to meet such cases that the dumdum, or "man-stopping bullet" was produced. There is abundant evidence that in the present state of the art of railroad operation, there is room for some sort of dumdum train signal—one that will not only indicate danger, but one which will actually prevent a train rushing on when it should stop. The recent serious rear collision on the line of Central Railroad of New Jersey and the accident in the New York Central tunnel about a year ago, both of which have, we believe, been atrributed to the disregard of danger signals, has focussed public attention on the feasibility of a train-stopping signal.

Last month we published the substance of an account of some tests made in Germany with a new safety device for railways (page 93), which had been communicated to our government by the United States Consul-General at Berlin. A "third rail" laid in the center of the track can, when electrically charged, be made to audibly and visibly warn the engineer of danger and apply the brakes.

Another safety device is thus described by the *New York Tribune*: "On Swiss roads tests are being made with the following plan: At points where trouble is anticipated a stout metal arm is placed between the rails and arranged so that it can lie down when no service is required, but it can be raised on end by block signal or other apparatus when there is danger ahead. On the under side of the locomotive is a swinging lever, which will pass clear of the arm when the latter is in the 'safety' position, but will be hit thereby when the arm has been thrown up. The motion of the lever automatically sets the air-brakes and warns the engineer."

There have been many and various devices brought out in this country for dealing with a moving train if it runs past a block signal. The Kinsman method of train control was designed to close the throttle and apply brakes, the engineer, however, being free to reopen the throttle and release brakes, if he saw fit. The Miller block signal apparatus is a most ingenious device for reproducing in the cab the same indications which are shown on the stationary block signals along the track. As appropriate electric lamps glow steadily in the cab in front of the engineer he cannot pass the signal so given, without seeing it. The visibility of the signal is thus virtually prolonged. This system, as far as we know, does not apply brakes.

A train signal, which will no doubt be developed before long for use on crowded lines where track capacity is taxed to the utmost, we may venture to predict, will be competent to deal with the engineer who "takes chances" or has missed a signal for any reason, just as the dumdum bullet deals with the onrushing savage—it will stop him. We do not believe that there will be an expensive or elaborate apparatus evolved, that is not necessary, but the device must be always effective and not liable to derangement. The Boston elevated road has automatic stop signals installed by the Union Switch and Signal Company. Not long ago one of these stopped a train which was proceeding past a danger indication, owing to the motorman having fainted.

The serious point about the responsibility of an engineer in the matter of obeying signal indications is that practically he does not share it with others. Whatever may be the theory regarding the fireman's responsibility in the matter, he does not invariably look for these signals, and he is usually not favorably placed to see them, and his work prevents him from being always on the lookout, nor does the conductor personally note the engineer's obedience or the reverse at every semaphore and in every block, and the passenger brakeman is in much the same position as the conductor. While we admit that all this is the case, we do not think the "third man" in the cab is the correct solution of the problem, for reasons which we give elsewhere.

A device that would simply open an air valve somewhere in the train line, and apply the brakes in the emergency, would be a most useful and efficient safety device. Its value in foggy or snowy weather does not require to be enlarged upon. The valve should, when once opened, not be closable by a person on the engine, thus insuring that the stop called for by the signal be actually made. The stop having been made, enginemen and trainmen would all strikingly realize the situation perhaps without the need of a second lesson. In any case the valve could be made to register its operation, which would be an aid in the enforcement of discipline.

An argument against the use of such an automatic stop signal is that in time men would rely solely on it and relax their vigilance and if the signal got out of order, it might give no indication of its derangement and so cause an accident. Relying upon automatic mechanism, which has to be kept in good order, is exactly what men do who travel at high speeds, and expect the air-brake to stop the train in a given distance. If they did not have confidence in the brake they could not maintain the speed up to the point they now do. The signal, if it ever comes, would have to be maintained in thoroughly good order just as the brake is now. If such a device was in successful operation the possibility of "taking chances" in the hope that a signal will "clear" at the last moment, or the honest failure to see a danger indication, would then be dealt with alike, in the imperative demand for absolute safety. An automatic signal showing "stop" would then not only silently give warning, but would actually halt the train before the menace of danger which it indicates had developed into death-dealing catastrophe. The gradual elimination of that most uncertain factor, the human element, in railroad operation is the only road to safety, because, while men may dare to put conjecture in the place of certainty, or may, with preoccupied mind, pass a danger signal, with all the terrible possibilities which that act involves; the old French proverb will still hold true with an added and intensely sinister significance: "It is the unexpected which happens."

Unpopularity of the Pooling System.

There has been so little said about the pooling of locomotives during the last year that we supposed the system had been improved so much that enginemen had become reconciled to it and the railroad officials were finding that it increased the number of engines available for hauling trains, thereby increasing the power available for service. We supposed that all concerned were enjoying the advantages claimed for the pooling system, and the natural inference was that experience had smoothed down the disadvantages until they were out of sight. The advantage claimed for operating locomotives with different crews are that it saves a large investment of capital in power, decreases the amount of fuel wasted in housing, banking fires and restarting them, and saves

round-house room and fuel and plant for warming them in cold weather. Where there are an unequal number of trains in opposite directions the pool system gives the men equal hours of rest and equal hours of labor.

We recently had a visit from the superintendent of motive power of a large railroad system which has for years operated its locomotives on the pool system, and the subject of pooling coming up in the course of conversation, he spoke very vigorously against it. Instead of increasing the power available for moving the congestion of freight cars be expressed the belief that it tended to reduce the number of locomotives ready for work. We published several years ago a letter from a railroad superintendent enumerating a variety of disadvantages inseparable from the pooling system which covered the objections raised by our visitor. He admitted that it was impossible to change human nature sufficiently to make an engineer or fireman working in a pool take the same interest in an engine that they handled once a month as they did when they had the same engine every trip they made. The personal care bestowed upon locomotives has more money value to railroad companies than it has been the custom to recognize.

An engineer once asked us the question, "Will the pooling system of despatching engines ever be done away with?" We answered, "When experience has proved the system less remunerative, as more expensive to maintain than where each crew has and keeps its own individual engine, then will pooling be abolished." We are now inclined to modify that opinion. There are railroads now whose officials believe that the pooling system is more expensive than the individual system, but the difficulties of making a change are too great to be carried out during the present rush of business. Our visitor informed us that they were working to modify the pool system and that an entire change will be effected gradually. He discussed various phases of the pooling system, one of his strongest objections being that pooled engines broke down on the road frequently and often demoralized the train service to an extent never experienced with engines run on the individual engine system.

The following are a few of the leading disadvantages of the pooling system as described by a railroad official who had endured the grief and worries which the system entails: "Engines go over the road with rods and driving boxes pounding, injectors that take part of a week to prime, injector throttles leaking, lubricators with glasses full of sediment and the joints leaking, handles broken off gauge cocks and air pump throttle, an air pump that does more groaning than pumping, a fire-door that won't stay open, a shaker-bar that slips off the post and permits the fireman to go back against the coal gate or else take a run for the boiler head, and other defects too numerous to mention.

The wear of valves and running gear is great on account of some men being careless, and too close attention to oil records on the part of others. An engineer can make an oil record at some other's expense, by using just enough to get over the road. The next man on the engine must make up for the deficiency or be troubled by squeaky valves, hot boxes and delay reports. The engine soon gets lame, and as she is in the pool it is not reported, as one man does not care to report more work than another, and the crew do not expect to get the engine again, so do not care.

The steaming qualities of engines are neglected. A fireman has a new engine to learn each trip. As a man must learn to fire an engine before he can be economical with fuel there is a great waste of coal, as each trip is an experiment. One man succeeds with a poor engine and gets over the road, so as long as anybody can keep her hot there is no change made, as no two suggest the same remedy. As a man is probably on an engine only one trip he does not have time to locate the trouble, then somebody else tries it and so the engine continues a poor steamer."

Overloaded Trains Cause Freight Congestion.

The freight congestion which all of the roads West and East are experiencing at the present time, due in most part to their inability to furnish sufficient motive power to move the enormous quantities of coal which is being daily taken from the mines is the worst known in the history of local railroading. The blockade of freight of all descriptions extends from Boston and other New England points all the way into Chicago and nearly all of the terminals in the South and Southwest. Every available inch of track comprising the extensive yards of the trunk lines between New York and Chicago is crowded with freight cars which cannot be moved, and the most favorable views of those familiar with the conditions cannot see the immediate relief of the situation. Instead, the officials state that the situation will become still more severe.

In a great many instances those responsible for the congestion of freight traffic go the wrong way to relieve it. A recent dispatch says that general managers of Western railroads have agreed to effect a great reduction in operating expenses to offset the increase in price of all railway supplies and labor. The plan is to reduce the speed of freight trains about 20 per cent., so fewer but longer trains can be hauled. There will be a small saving in wages, because of the reduction in the number of trains, but this is an incidental saving and is not one of the chief objects aimed at by the managers.

That is exactly the way to make the congestion worse and the motive power less efficient. Correspondents of RAILWAY AND LOCOMOTIVE ENGINEERING who have made a special study of train movements have repeatedly demonstrated in our pages that an engine loaded to pull a train at a speed of 18 miles an hour would earn considerably more revenue than one loaded down to a speed of 12 miles an hour. If railroad officials would study the earnings of engines hauling stock trains that have to be run at moderately high speed, they would learn something that would prevent them from talking about reducing the speed of freight trains to reduce expense.

An excellent analysis of the work done by two engines was given by a railroad official who supervised the experiment. A standard engine could make 17 1-2 miles an hour with 700 tons behind the tender. With 800 tons the average speed was reduced to 10 miles an hour. In a test of 24 hours the engine hauling 700 tons made 420,000 ton miles, and the engine hauling 800 tons made 272,000 ton miles. The fairly loaded engine worked 54 1-2 per cent. more ton miles than the other.

QUESTIONS ANSWERED.

(13) W. M. A., Bellefontaine, O., writes:

We have a number of Atlantic type engines that have by-pass valves on the steam chest, they use piston valves and we have a number of consolidation engines that have piston valves, but no by-pass valves. What are the functions of by-pass valves on passenger engines alone? Would they be of any advantage on square steam chests? A.—The function of by-pass valves is to prevent the churning of air in cylinders or steam chests when engine is drifting. When steam is being used the valves close tightly, but when running shut off, they open and permit the air in front of a piston to pass through them to the back where it is drawn in behind the piston. On the return stroke the reverse operation takes place. They are not used exclusively on passenger engines or exclusively on steam chests, but they are only useful where a piston acts, as they do away with the churning of air and so permit freer movement. On an ordinary square slide valve steam chest they would not be necessary, as the air in the chest easily passes beside or over the valve.

(14) A. R. S. asks:

First—Can you give me a brief answer

to the question, What is a locomotive? A.—A locomotive is a steam engine and boiler carried on wheels, some of which receive power from the engine for the propulsion of the vehicle which carries engine, boiler and their necessary attachments. Second—What is steam? A.—The vapor produced by boiling water. Third—How does steam pass from the boiler to drive the engine? A.—When the throttle valve in the dome is opened the steam enters the dry pipe, passes to the branch pipe in the smoke-box, when part goes down each steam pipe to the steam passages in the cylinder saddle, from whence it flows into the steam chest. From there it is admitted into the cylinders by the valves. Students of such questions as these ought to have our valve motion model as an assistant. The small model costs only ten dollars, or it is sent to any one who secures twenty-four subscribers.

(15) Machinist writes:

We had a dispute the other day in the shop about the water supply that two sizes of pipes would carry. I wanted to use two one-inch pipes instead of one two-inch pipe, and the foreman said I was off my nut. What was the matter? A.—You need badly to study Machine Shop Arithmetic, which is for sale in this office. We dislike to answer elementary questions of this character. The cross section of a pipe is the amount of space open to let anything pass through. The cross section of one circular inch is .7854; the area of a circle two inches diamater is 3.1416, or four times the area of one inch. A mechanic ought to be ashamed of not knowing things of this kind.

(16) M. L. writes:

I am offered at low cost an interest in the patent of a reversible steam engine which has only one eccentric. Do you think it would be a good investment for the savings of a workman? A.—Do not put any money in it. Reversing valve gears with only one eccentric have been invented repeatedly. If you can obtain a copy of the Annual Report of the Railway Master Mechanics' Eighteenth Convention, you will find illustrations of several valve gears that have only one eccentric.

(17) R. M. K. writes:

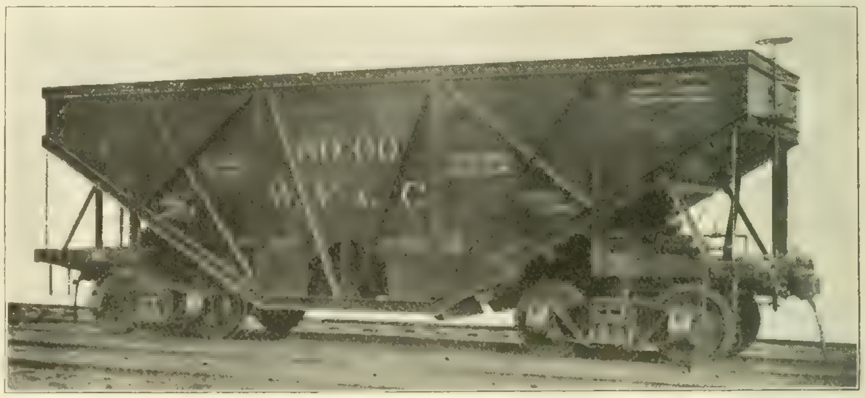
When a person invents a new and valuable device and pays the government a high price for getting out a patent, is it not the duty of the government to prevent others from making use of the device without paying royalty? A.—Protecting patentees ought to be the duty of the government, but it never has performed that duty. Punishment for infringers of patents is left to the law courts.

(18) Engineer, New York City, asks:

Can you inform me how I ought to proceed to obtain a license as a marine engineer? A.—By applying to the Boiler Inspector's office, in the Post Office, New York, and passing the examination. By the study of Hemenway's "Catechism of the Steam Plant" you will obtain information that will help you to pass the examination.

A Typical Vanderbilt Car.

The Vanderbilt 100,000-lb. high-side steel hopper gondola shown in our half-tone illustration is a typical example of this form of construction. There are two center sills which pass through the middle of the hopper, but there are no side sills, except the short ones which extend from bolster to end sill. Two upright channels riveted to the car sides and terminating at the bolsters, help to carry the weight. The sheets which form the sides of the hopper are stiffened with angles just as a bridge truss would be made. The car was built by the Cambria Steel Company for the West Virginia Company for the carriage of ore, etc. The trucks used were also specially designed by Mr. Vanderbilt and were illustrated in detail in a former issue. Altogether the substantial form of construction of this car is apparent to even a casual observer.



A TYPICAL VANDERBILT CAR

Government Rule in Boiler Inspection.

A subscriber asks us to tell him what rule, if any, is used on railroads for the reduction of pressure on locomotive boilers on account of deterioration from age. He also asks what is the practice of the U. S. Government.

The overhauling of locomotives is comparatively so frequent that no definite rule has been adopted by railways for reducing the pressure from time to time. The government practice, however, is interesting and as set forth in the general rules and regulations prescribed by the board of supervising inspectors of steamboats, is an example of scientific and safe practice which should be known to all steam users.

The boiler plates used in the construction of steamboat boilers are required to be stamped with the name of the manufacturer and place of manufacture and the number of pounds tensile strain it will bear to the square inch. Boiler plate made previous to the passage of the act are assumed to have a tensile strength of 50,000 pounds to the square inch.

The rule prescribes that any boiler having been in use ten years or more when inspected thereafter shall be drilled at points near the water line and at bottom of shell or in the thinnest place which the inspector can find. The least thickness of plate at any point is taken as the thickness of the whole boiler, on the principle that a chain is no stronger than its weakest link. Having ascertained the actual thickness of the sheets, one-sixth of the known tensile strength is taken and the pressure for the particular boiler under examination is calculated from that. For example, a boiler 36 in. in diameter made out of ¼ plate is allowed 104.16 pounds to the square in. A table giving diameter of boiler, thickness of plate and pressure allowed, facilitates the work.

Heating Surface Compared with Familiar Things.

The 2-8-2 engines recently turned out for the Santa Fé by the Baldwin Locomotive Works had each a total heating surface of 5,366 sq. ft. To get an idea of what that looks like when spread out, we may say that it is not quite as large as the area of the pits in which two 60-ft. turn tables can swing. If you cut out the area enclosed between the rails of only one of the tables, you will come very close to the amount of heat-absorbing surface presented in these boilers. The tandem compound Decapods built last year for this road at the Baldwin Works had 5,390 sq. ft. of heating surface. A tennis court measures 36-ft. wide by 78-ft. long, and encloses 2,808 sq. ft. These Decapods had each a little less than the equivalent of two tennis courts tucked away inside their boilers. A strip 3-ft. wide cut off one side of one tennis court leaves the rest of the marked off lawn very nearly equal in area to the heating surface of these monsters.

Air-Brake Department.

CONDUCTED BY F. M. NELLIS.

Air Brake Association Convention.

The first railroad mechanical convention of the year will be the Tenth Annual Convention of the Air Brake Association, which will be held in Colorado Springs, Colo., beginning April 28. The Hotel Alamo has been selected for convention headquarters, and is easily accessible by the several street car lines of the city. Members should take receipts for all fares paid in Pullman cars, and upon presentation to the Pullman agent in Colorado Springs of said receipts and 1903 membership cards, a free return ticket will be issued.

It will be interesting to note the success of this first meeting of the Air Brake Association in the far West, and it is to be hoped that the success will be greater than has been achieved by similar conventions in past years. However, should the meeting not enjoy an attendance equal to previous eastern conventions, no mistake will have been made, for it is but just that the persistent efforts of the western men to secure a convention should be rewarded. Many eastern members have recognized and believed this, and given their votes to the cause. Reward will doubtless be theirs, for the committee on arrangements, which is composed exclusively of western men is exerting itself to present to the eastern members a schedule of entertainment that savors exclusively of western hospitality.

Water in Train Pipes.

One of the most important subjects coming before the Air Brake Association Convention next April, is that of water in train pipes. This subject was before last year's convention and a great deal of valuable information was presented by the committee reporting on it. However, the important finding of the committee that the major part of the water got into the pipe while held in suspension, as moisture in the warm air, instead of gaining entrance at the leaky packing nuts of the piston rod of the air pump, and at dragging hose couplings, was insufficient; hence the committee was continued over to this year, with especial instructions to obtain the proper length of pump discharge pipe to properly cool the warm air sent by the air pump to the main reservoir, there to deposit its moisture.

Although the task imposed is exceedingly difficult and hedged with certain annoying and uncertain conditions calculated to seriously interfere with the work, yet the committee has done sufficient preliminary work to forecast a supplemental report that will be of value to the Association and a credit to the committee.

Outfit for the Air Brake Convention.

One of our subscribers, who is also a member of the Air Brake Association, has written us, asking what kind of an outfit of clothing he should take to the convention, as he has never been in Colorado. Briefly we would advise a straw hat, light flannel suit, low shoes, beaver cap with earlaps, ulster and arctic overshoes. The first outfit for the delightful weather in and about Colorado Springs, Garden of the Gods and Manitou, and the latter for a trip up Pike's Peak, if the blizzards haven't snowed it under.

Oil Cup for Air Cylinder.

We illustrated in this department, February issue, cuts and description of a sight feed oil cup for the air cylinder of air pump.

The time has undoubtedly arrived when a better method of lubricating the air cylinder of the air pump should be furnished than is now supplied. The little oil cup now used, and having grown up with the pump since its first introduction, is really inadequate for the purpose of oiling the air cylinder. It was sufficient in years past, when 6 to 25 air-braked cars were hauled in the average train; but in modern times, when trains frequently reach to 80 and 100 operative air-braked cars, the supply of air pressure being greatly increased, it is but reasonable to suppose that a more efficient lubricator be supplied for the air cylinder of the pump.

There are a number of air cylinder cups on the market, each having its own value and experience. Some of these cups are good enough to recommend, while others at least deserve a trial. Altogether a cup which is intended to meet the needs of the air cylinder of the modern air pump is entitled to consideration, and careful trial and experiment.

There are one or two important features that we would suggest be kept in sight by inventors of oil cups for air pump cylinders, and these are the point on the air cylinder at which the cup is located and the oil introduced into the cylinder, and the feed be made sight and automatic. Most of the cups invented thus far have occupied the place vacated by the old cup in the top head near the upright wall of the center piece. One or two others supplied the oil to the cylinder at mid or half stroke of the piston. This position seems to be the most advantageous point at which to introduce the oil, except for such cups as depend for their operation upon the minimum and maximum pressures of the air cylinder. Cups of this kind would naturally retain the position on the top head, but there seems to be so many advantages possible from the use of mid stroke position that inventors and designers would do well to keep this in mind as a very important consideration.

The sight feed feature seems to be one worthy of consideration also. Especially is this true, as that seems to be the better way of insuring the constant, regular feed, so essential to perfect lubrication. The old cup's prime fault is its flood and drouth way of sending the lubricant to the cylinder.

Desoe's Colored Air Brake Charts.

We issue with this number the first of Mr. Desoe's colored air brake charts. Others will follow.

Colored graphic charts have long been considered the plainest and most comprehensive method of placing a group of details for easy and ready understanding. Mr. Desoe was the originator of colored graphics to illustrate air brake pressures, his first work appearing in LOCOMOTIVE ENGINEERING seven or eight years ago. So great was the success of the colored graphics that other publishers of air brake matters quickly adopted the scheme.

The latest work of Mr. Desoe along this line will appear in several numbers of RAILWAY AND LOCOMOTIVE ENGINEERING. The different pressures in the several parts of the air brake system, under different conditions, have been carefully prepared by Mr. Desoe in a manner that is at once readily seen and understood. Don't miss any of these charts.

Good News—Our Congratulations.

The following notice, issued by F. B. Smith, M. M., and approved by Mr. John Henny, Supt. M. P., New Haven Railroad, will be good news of Mr. Oviatt, who merits and deserves the promotion.

"H. C. Oviatt, at present Air Brake Inspector, is promoted to Foreman of Engines, he to have charge of all engines and crews and engine despatchers now under the jurisdiction of Master Mechanic Hocking, he reporting to and receiving instructions from Master Mechanic Hocking. Engineer E. W. Alling is promoted to Air Brake Inspector, vice H. C. Oviatt, promoted."

CORRESPONDENCE.

Odd Work for Air Pump.

I am sending you a photograph of a deep well pump, designed and built by Mr. Geo. A. Miller, superintendent motive power and machinery of the Florida East Coast Railway. The steam engine part of the pump was worked out by Mr. Miller and myself, and is made of three steam cylinders of the 8-inch Westinghouse air pump. It has a stroke of 29 inches and cylinder bore of 8 3-8 inches. The three cylinders are set one on top of the other. The lower main steam valve bush in the top cylinder, as also in the middle cylinder, are reamed large enough to allow the small piston on the main steam valve to pass through easily. The upper and lower main steam valve bush, as in the middle cylinder, are tinned and replaced, and the space filled in around them with white metal, as also is the lower main steam valve bush in the upper cylinder and upper bush in the bottom cylinder. The cylinders are fastened together by turned rivets. Copper joints are used between the cylinders which are calked inside and out.

The cylinders were bored out in the lathe. The main steam valve was lengthened to correspond and also the reversing valve stem. The bottom head is made of an old casting, and the exhaust passage made smaller to restrict the exhaust from the under side of the piston and to overcome a quick down stroke, due to weight, etc. It makes an even, easy working pump, and runs about 27 strokes per minute, although it has worked as high as 34 per minute.

The well is 85 feet deep, and the pump piping is 4 inch. The pump is estimated to throw 2,700 gallons of water per day, but has never run over 5 hours at a time yet.

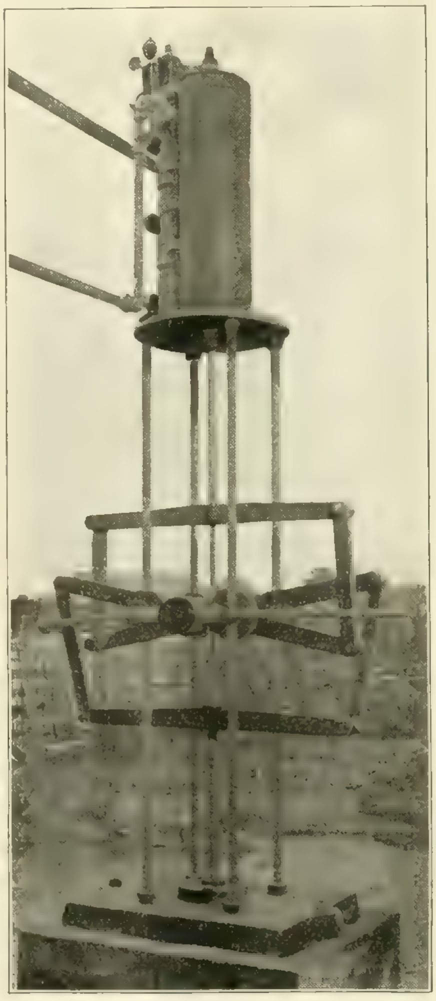
GEO. E. MCDOUGAL,
Air Brake Repairman Fla. E. Coast Ry.
St. Augustine, Fla.

Urges to Attend Air Brake Convention.

Although not a member of the Air Brake Association, I take this liberty and opportunity to urgently advise all members to strain every effort to attend the coming Colorado Springs Convention. In the past (in my humble opinion) the side excursions have played a very prominent part of all conventions, and although the recreation of these little trips is very pleasant, the actual knowledge gained has been of little value. Any trip taken out of Denver will be a revelation to perhaps 90 per cent. of the eastern members.

It will be demonstrated there how far a train can run on one application, how hot ordinary cast iron wheels can get without breaking; how to adjust brakes by other means than looking at the travel of the piston, and that it is not necessary to have an air pump smoke in order to keep up sufficient air to handle the train; that the governor is not a safety valve to be held open constantly, and that the proper place for the air pump is not on the left hand side.

Now, Mr. Editor, there are many other little points, but as I have said enough to probably bring the indignation of some of the more sensitive members on my head, I will stop, only to say to the members that can possibly attend, go!! They will be well paid by the pleasure, experience and knowledge they will have gained; and I can't help thinking that some of the theory now being practiced in the East will be somewhat modified.



WATER PUMP BUILT UP FROM THREE STEAM CYLINDERS OF EIGHT-INCH AIR PUMPS.

JOHN FROST.
Kansas City, Mo.

Recharging Device.

Fig. 1 is a diagrammatic view showing my complete invention with parts shown in section. Fig. 2 is a sectional view showing the arrangement and construction of an improved valve constituting a part of my invention. Figs. 3 and 4 are views showing a valve made use of to regulate the air pressure.

The operation of the device is as follows: As in the ordinary automatic train-pipe system, a reduction in the train-pipe pressure causes the application of the brakes, and to hold the brakes the engineer's brake-valve is placed on lap. Then to increase the pressure in the train-pipe the valve 32 is opened to admit the air from the main reservoir 1 through the pipe 23 into the upper end of the the valve-casing 25 to the lower valve 26 in order to force the latter downwardly, so that the air can pass from the main reservoir to the train-pipe through the pipe 28. As the pressure within the train-pipe 12 is reduced, the valve 26 is forced downwardly in its casing, and opens the pipe 28, normally closed by the lower end of the valve. This permits the air from the main reservoir to pass into the groove between the ends of the valve 26, and the valve is carried down until its lower end assumes a position between the points at which the pipe 29 opens into the valve-casing 25.

In this position the upper end of the valve 26 is above the entrance of the pipe 28, which adjustment permits the air from the main reservoir to pass in a moderate stream through the pipe 28 into the valve-casing 25 and out through the pipes 29 and 30 into the train-pipe 12. This raises the pressure in the train-pipe, which reacts on the valve 26 for the reason that its lower end is larger, and being of greater area than is its upper end, which results in the valve being forced upwardly again until it assumes the position shown in Fig. 1, in which the pipe 28 is closed, preventing further passage of the air there-through.

As the pressure in the train-pipe is increased it will pass through the pipe 13 and raise the valve 19 a sufficient height to admit the flow of air into the auxiliary reservoir 7, until the pressure is equalized between it and the train-pipe. As the air flows from the main reservoir, the pump begins to work and replaces the air just drawn out, which operation is repeated for every reduction made to set the brakes. To release the brakes, the excess pressure in main reservoir is turned into the train-pipe 12, and it will instantly force the valve 19 against its upper seat 21, thus cutting off all communication between the train-pipe 12 and the auxiliaries 7 and forcing the air to pass through the triple valve in the usual manner.

BENJ. W. SMITH.
Princeton, Ind.

Air brake men attending the Colorado Springs Convention should do as follows: *Pay dues.* Apply for transportation to nearest official. Take receipts for fares paid in Pullman cars. Go prepared to have a profitable and enjoyable trip.

Caboose Brake Apparatus.

Now that "all air" freight trains are becoming a not unfamiliar sight on other than western roads, the time is ripe for a more than passing consideration being given to the caboose brake apparatus. The writer believes all cabooses should have a train pipe, a conductor's valve, an air gauge, an air brake, where other than the light four-wheel type, a maximum air braking power of not less than 55 nor over 60 per cent. of the empty weight, and a rigging so designed that the hand and air brakes will work together.

The need of a train pipe on even the short, four-wheel caboose is so evident as to require no argument.

The value of a conductor's valve, located in the cupola, lays in the promptness with which the brakes can be applied from the caboose in case of a derailment first observed from the caboose or in any other emergency where the impending danger is liable to be more serious than the bad effects liable to follow the use of the conductor's valve, such as damage to draft rigging, wheel sliding and stuck brakes.

Abuse of the conductor's valve is no good reason for not installing it, as where the fault has proven serious, sealing it, and requiring an explanation whenever the seal is broken, has proven an effectual remedy.

But the most valuable feature of all is the caboose air gauge, so located in the cupola as to be easily seen, both day and night. Such offers the following advantages:

First. It enables the conductor to determine whether the train pipe is open to the engine, as if this were not so it would be followed by a steady fall in pressure. Manifestly, this is of the utmost importance, as some of the most serious accidents have resulted from an assumed length of open train pipe that did not exist.

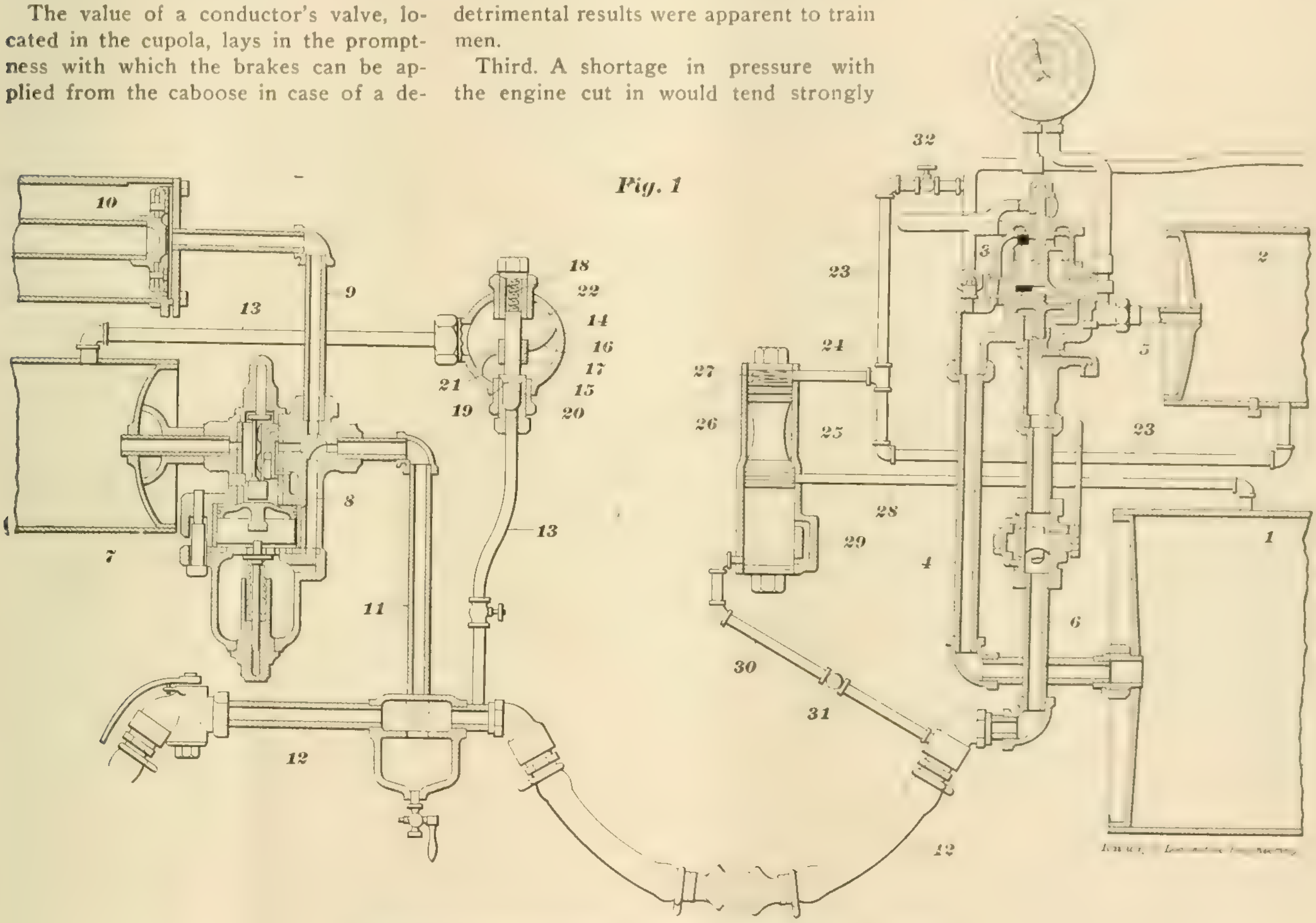
Second. Excessive leakage is made apparent by the rapid fall in pressure when the supply is cut off or inability to obtain standard pressure when cut in. There can be little doubt that more would be done to remedy leakage if additional evidence of its existence and detrimental results were apparent to train men.

Third. A shortage in pressure with the engine cut in would tend strongly toward greater precautions being taken by trainmen to prevent trouble. This applies particularly on descending grades where full pressure may have been had at the summit, but which is seriously reduced by indifferent work on the part of the engineer or owing to circumstances over which he has no control, as, for example, a material increase in the leakage.

Fourth. Where, on a heavy descending grade, the pressure has been much reduced during a stop, and due to the brakes being held on, engine cut off or a burst hose, there would be less likelihood of the train being allowed to start until full pressure was regained if the exact conditions were so easily determined by the conductor. It is not believed that, as a general rule, trainmen are prone to take, knowingly, great chances of trouble; therefore, that the too frequent starting of a partially charged train through the release of hand brakes would be materially reduced by the use of the caboose gauge.

Fifth. With such a gauge there would be no excuse for an inspection for leakage and attempt to test brakes when the pressure was low, now too frequently the case. This would apply to inspectors as well as to train men, as the former could be instructed to determine by this gauge that a sufficient pressure was had before inspecting for leakage or signaling to apply brakes for test. They could as well determine the amount of the reduction made for the test and thus do their work more intelligently.

Inspection of many caboose gauges indicates that such require far less attention to keep them accurate than do the locomotive gauges, this being due to the far more severe service to which the latter are subjected. In fact, the only test necessary would be an occasional comparison with the locomotive gauge, and which would naturally be made each



DIAGRAMMATIC VIEW OF SMITH'S RECHARGING DEVICE

trip. This would be simplified and serve as a counter-check if conductors were required to note on their defect cards for each trip the maximum pressure carried, thus checking both the caboose and engine gauge, and the train pipe regulator

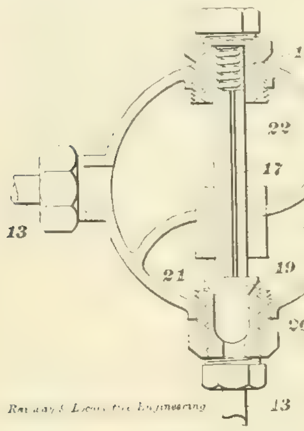
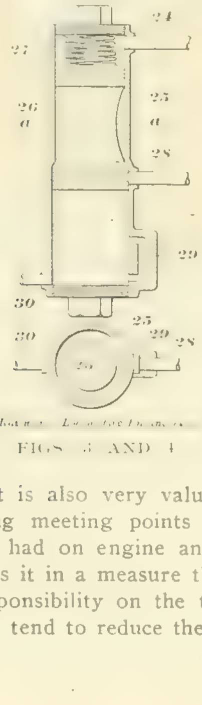


FIG. 2

as well. A single pointer gauge is all that is needed, and such with a fairly good mechanism in a plain but substantial case, can be obtained at a very reasonable price, with no sacrifice of excellence.

An air brakeman with large experience and observation, in answer to an inquiry on this subject said, after stating that on the Santa Fe lines west of Albuquerque, N. M., all cabooses were fitted with air gauges:

"There is nothing connected with air brakes that, for the cost, will any way near bring the returns as will a gauge in the caboose. On the dangerous grades of the Santa Fe lines it is the practice for the engineer to hold the train with the air; however, shold the pressure drop to a dangerous point, the conductor holds out his white light and the train men at once assist with the hand brakes, and this without the engineer calling for



FIGS. 3 AND 4

brakes. It is also very valuable when approaching meeting points if a poor pump was had on engine and pressure was low, as it in a measure threw some of the responsibility on the train crew. It also will tend to reduce the complaint of engineers that a "dynamiter" caused the break-in-two, as the train crew can tell if such "dynamiting" really occurred or excessive reductions, due to carelessness, are being made by the engineer; or if second reduction follows before the slack is bunched. It will reduce the number of stuck brakes, as train men soon learn to comment on those enginemen who make excessive reductions—below equalization—or that fail to leave the handle in full release a sufficiently long time to release all brakes. I can recall several instances where the gauge detected the failure to open angle cock after coupling up crossings and on account of the hurry would have gone undetected perhaps until a stop was attempted."

The average four-wheel truck caboose is enough heavier than the average freight car to develop as much holding power and yet not brake above 60 per cent. of its light weight. The fact that its brake can easily be kept in good order makes it even more valuable than the average freight car brake.

In some cases, at least where cabooses are fitted with air brakes, there is observed a tendency among the trainmen to keep these brakes cut out. One cause of this is too high brake force and the resultant flat wheels. Another is believed to be the air brake working against the hand brake, rendering it unsafe at times to use the latter. Yet another is lack of provision for releasing the caboose brake while running, desirable at times when switching with it, or at any time when the air brake is applied and it is desired to set the hand brake. It could be arranged so the air brake could be released from either platform.

The caboose brake equipment is deserving of much more attention than it has generally received in the past. In conclusion, it should be said that some of the western roads learned the value of the caboose gauge long ago, and have profited by it.

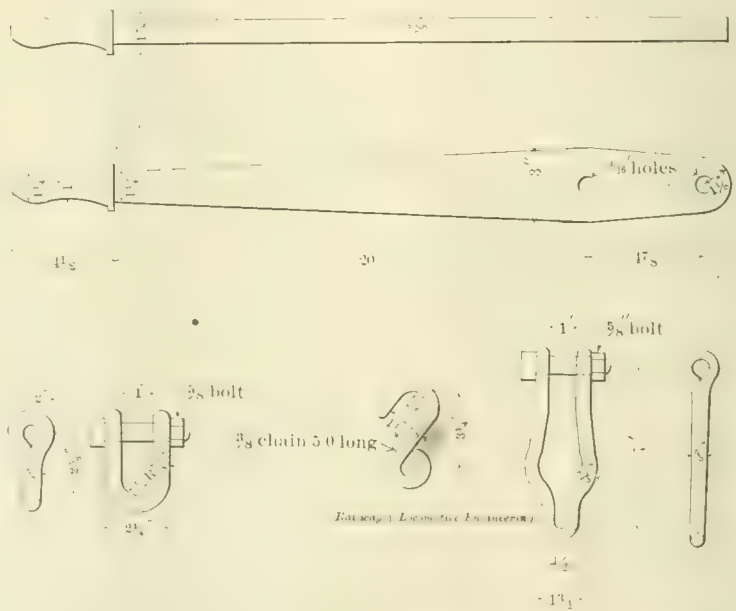
St. Paul, Minn. F. B. FARMER.

Slack Take-Up Device.

I send you a drawing of a very handy device for taking up slack at the top rod of six-wheel passenger car trucks.

To use the device, the short straight link is hung over the main connecting rod, just behind the Hodge lever, and the adjusting lever coupled into the link by its end hole with the 5-8 bolt. The handle should point to the ground, and the grab link, which is coupled to the second hole in the lever, pointing ahead toward the truck.

The common hook, shown at the bottom of the drawing, to which is attached 5 feet of 3-8-inch chain, is then hooked over the top truck rod, just ahead of the floating lever, and the chain passed through the grab link. Then one man sitting on the ground can push the adjusting lever ahead until he takes up enough of the chain to give himself a good purchase and pull up all the slack in the brake gear and hold it until a bolt is removed. He can then pull up a hole or let one out, as the case may be, to secure the desired adjustment.



HANDY DEVICE FOR TAKING UP SLACK IN BRAKE RIGGING

The lever is made from an old Millar drawbar uncoupling lever, and the whole device is very cheaply got up. It is a time and trouble saver.

W. C. HUNTER,
Air Brake Inspector, Intercolonial Ry.
Moncton, N. B.

QUESTIONS AND ANSWERS

On Air Brake Subjects.

(16) R. E. J., Pueblo, Colo., asks:

Is the 3-position retaining valve now being issued as part of the standard equipment, or is it only out on trial? A. —It is a regularly listed part of the Westinghouse standard equipment.

(17) J. L. E., Battle Creek, Mich., writes:

I hear that F-46 triple valve is to be supplied in the future for all locomotives with brake cylinders more than 10 inches in diameter, instead of the special engine triple; how about it? A.—Your understanding is correct.

(18) C. P. McG., Buffalo, N. Y., asks:

What are the inside dimensions of the Westinghouse cast iron auxiliary reservoir for the 8-inch freight brake cylinder? I wish to find the cubic contents or volume. Also, what do they call the cubic contents of the 10x33 auxiliary reservoir used with the 10-inch brake cylinder? A.—The cubic capacity of the cast iron auxiliary reservoir for the 8-inch freight brake cylinder is 1,620 cubic inches. The capacity of the 12x33-inch auxiliary reservoir for 10-inch brake cylinder is 2,156 cubic inches.

(19) N. R. E., Buffalo, N. Y., writes:

1. How can you distinguish between the three kinds of Westinghouse plain triple valves, the G24, the F25, and the F46? A.—1. The "name" of each triple is cast on its body. 2. What is the difference in these triple valves? A. 2—There is a slight difference in size of the ports and parts to adapt each to its special work. The G24 triple is for 8 and 10-inch tender brake cylinders on freight and switching engines, the H24 for 8 and 10-inch driver brake cylinders on all kinds of engines, the F25 for 12-inch tender-brake cylinders on freight and switching engines, and the F46, or "high speed" triple valve, for all 12, 14 and 16-inch driver brake cylinders.

(20) B. B. C., Chicago, Ill., asks:

Is the omission of the train pipe from the cuts of driver and engine truck brakes in Figs. 4 and 6, on page 27 of January number a mistake? A.—Not a mistake, but an oversight. They might as well have been put in; but as the main object was to show the location of the cut-out cocks in the auxiliary reservoir pipes and brake cylinder pipes, and as the location of the triple valve would do this without the aid of the main train pipe, the omission of the train pipe, although accidental, was not considered serious.

(21) B. B. C., Scranton., Pa., asks:

Why is a larger brake valve reservoir being supplied? What are its outside dimensions? In what service is it used? A.—The Westinghouse. Air Brake Co has decided to make a change in the size of their standard equalizing reservoir for brake valves. As you know, the present reservoir is 10x12 inches. The modified reservoir will be 10x14 1-2 inches. This change was brought about by the desire of the Pennsylvania R. R. to increase the size of the equalizing reservoir, to prevent a possible quick-action application of the brakes when making a service application on a high-speed train, when the train contained but a few cars. Experience in the past on other roads has not suggested the advisability of such a change, but it has been thought best to eliminate all possibility of any tendency to get quick-action application with the high speed brake in making a service application.

(22) J. B. S., Hamilton, New South Wales, writes:

I was working an engine the other day, and when working with light engine only, in making a service application, the tender brake would go on properly, and remain on; but when connected to a train, it would not stay on five seconds. It would just go on and come off again every time. A.—The trouble is probably due to leakage in both the train line and auxiliary reservoir. With the light engine these two leakages will balance each other, and the brake will remain set. When the train is coupled on, the train-pipe volume is greater, and if the train line of the cars does not leak, the brake on the tender will bleed itself off by auxiliary reservoir leakage. Again, the triple piston packing ring may be in a sufficiently bad condition to permit the train pipe pressure on the light engine to leak past the ring into the auxiliary reservoir, keeping the pressures balanced, regardless of the auxiliary reservoir leakage. When the engine is coupled to a train, the train pipe volume would be increased to a degree that would not permit the train line and auxiliary reservoir pressures to equalize, and the auxiliary reservoir leakage would bleed the tender brake off.

(23) B. M. McC., Louisville, Ky., asks:

If you gradually draw all of the air out of a train line, will the graduating spring compress and will the valve move into emergency position? A.—Yes. To illustrate: Suppose we charge the train line and auxiliary reservoir to 70 pounds pressure. Now draw off 20 pounds from the train line, setting the brake full. We will now have 50 pounds pressure in the brake cylinder, auxiliary reservoir and train pipe each. Now, again, suppose we reduce the train pipe pressure 10 pounds more, thus making the train line pressure 40 pounds. As there has been no outlet for pressure from the auxiliary reservoir and brake cylinder, the pressures will remain the same therein. Consequently, the 50 pounds in the auxiliary reservoir being greater than the 40 pounds in the train line, and the resistance of the graduating spring, the triple piston and slide valve will travel to their furthermost limit, compressing the graduating spring. Of course, the graduating spring would also be compressed if all the pressure were drawn from the train line.

(24) J. B. S., Hamilton, New South Wales, writes:

On one or two of our engines here (all triples are set in slow action in this state) the tender brake would not operate, and by cutting the triple into quick action position, the air brake would go on with a "bang," even though the brake valve handle was placed in full release position, and the brake cylinder "bled." The only way it could be released was by placing the triple three-way cock in slow active position again, then the brake would come off immediately. Leave the brake valve handle in full release, and by simply pulling the three-way cock down to quick action position, the brake, as above stated, would go on with a regular "bang" every time. A.—There is something wrong with the quick action features of the triple valve. The emergency valve is defective, or some foreign matter has lodged on its seat, holding the valve open. In this event, and with three-way handle in quick action position, the train-pipe pressure would have a free and constant passageway to the brake cylinder and would remain on as long as there is pressure in the train pipe. Possibly the leather packing in the brake cylinder is faulty. If this be true, a slow admission of pressure to the cylinder, such as service application would give, will leak out quickly and perhaps as rapidly as it enters. When the triple is cut into quick action position, the train-pipe pressure would go into the brake cylinder faster than it could leak out. Clean the triple valve parts thoroughly, paying particular attention to the quick action mechanism, and note that the brake cylinder packing is in good condition.

(25) B. J. K., St. Paul, Minn., writes:

I do not understand from the sketch in February Railway and Locomotive Engineering how I am to drill the hole in the brake valve, or to strike the port for the governor to give the high pressure when the brake is applied, and the low pressure when the brake is off. A.—Draw a center line through the rotary valve seat and the part on the side of the brake valve to which the feed valve attachment is fastened. Draw a parallel line three-quarters of an inch to the side of this line—to that side nearer the main reservoir connection. Set your dividers for 2 67-128 inches, and from the center of the rotary valve seat scribe a circle through the parallel line. The point where this circular line intercepts the parallel line should be the center of your hole to tap into the port to the brake valve.

Mr. George Westinghouse on American Methods.

At Claridge's Hotel, in London, on the night of January 9, Mr. George Westinghouse entertained at dinner a large company of British railway managers, financiers and scientists. Two speeches of unique interest were made. One of these was by Lord Kelvin, the other, by the host of the occasion. Lord Kelvin said:

"At this dinner of friends I would like to express a common sentiment which all must feel, our appreciation of the qualities of our charming and beloved host, Mr. Westinghouse. I am sure that Mr. Westinghouse's coming to England reminds us all of the advantages that England has derived from his genius and perseverence and grand skill in bringing out for public good so many of the results of science and inventiveness. There are many railway men present at this table, and many passengers by railways—which means that every inhabitant of our country is represented here. When people belonging to these two classes—the railway men and the traveling public of Great Britain—are gathered together as now, we can scarcely see Mr. Westinghouse without feeling how much we owe to him for the Westinghouse brake. (Applause.)

"But Mr. Westinghouse has not stopped with his brake; he has gone on and on and on in America, flashing over again on this side of the Atlantic, and bringing his energies here. The present development of the electric industry in the United Kingdom owes its growth largely to him.

"'Largely' is a small word to express how much we owe to him. I do not wish to enter into any comparisons or superlatives, but I do not think any man in the world of engineering could be named to whom more is due than to Mr. Westinghouse for his work in electric engineering.

"Other things besides mechanical engineering and electrical engineering we owe to Mr. Westinghouse. We owe to him the bringing to England and causing to be appreciated in England, American methods—American methods in a certain way which I may refer to without invidious comparison; American methods of industry, and resolution, and determination—which are also English methods, because they have been inherited from England. (Applause.) Here it comes back to us, with compound interest, in the shape of Mr. Westinghouse, and I am sure that we all feel that we are largely indebted to him for what he has done for us, what he is doing for us, and in advance, for what he is planning to do for us in the future.

"We appreciate all this, and we appreciate him as a kind friend, a genial host and entertainer. I ask you to join me in drinking the health of Mr. George Westinghouse."

The toast having been honored with enthusiasm, Mr. Westinghouse rose to respond. He said:

"I wish to thank our distinguished scientific friend, Lord Kelvin, for the complimentary language he has used about me. And I would like to say to all you railway men here present, that my life has been very much associated with your calling. I invented the brake, of which Lord Kelvin has spoken, when I was scarcely twenty-one years old, and thus became acquainted with railway men when the railway industry was rather a poor one compared with what it is today. Since then I have closely followed railway operations, becoming acquainted with almost everything that is being done in them, and it is particularly my friendship with railway men which has prompted me to go forward in my work with an interest and keenness that probably would not have resulted from ordinary commercial motives.

"Lord Kelvin has been good enough to refer to my coming to this country. I came here thirty years ago, and for ten years or so I was here about half the time. At that time it was very difficult to get any new thing done in England. I often wanted to sit down and cry, because I could not get any one to believe in anything. (Laughter.) I wanted in those early days to try an iron brake shoe, because, on account of rapid wear we couldn't keep the wooden one adjusted. I had to beg and beg to be permitted to put a set of metal brake shoes on one tender on the Caledonian Railway. Finally I succeeded. You all know that now-a-days all the railway shoes or blocks are made of cast-iron or other metal and are used upon all the wheels of the train.

"Lord Kelvin has alluded to 'American methods.' May I say that one of your English difficulties is inherent, I think, in an old-world highly-developed country. After a man (or a nation) has worked prosperously for a long time, he opposes improvement or suggestion, thinking, 'What I have is good enough. I won't try a new thing.' In America, however, the necessities have produced different results. Lord Kelvin speaks of England having sent many men to America. It has also sent to us many ideas. If you take up the American patent records and follow the cases in litigation especially, you will find that among the references cited many are of English origin, some of them containing ideas so complete, the wonder is that the inventions disclosed were not established fully and completely in your own land. These records seem to show that Americans and Englishmen have invented the same thing many times.

"In America, however, we have always been short-handed with regard to labor. We have been obliged to find methods whereby one man may accomplish the work of two or three men as compared with your practice here. We have had the best men from Europe—Englishmen, Germans, French, everybody—skilled men, highly trained men, as well as laboring men; we have combined their experience with our own, coupled it with our necessities, and have thus accomplished results unattainable in a country like this where you have more labor than you can well keep employed.

"As an illustration of what has been accomplished by the use of electricity in a great industry, I may cite the Homestead mills of the Carnegie Company. Mr. Schwab, whose name is well known to you, is a genius in his way, particularly in the management of men. He is a master in organizing and directing men. Mr. Carnegie believed in him, and if Mr. Schwab made a suggestion in regard to the use of new appliances, even if it involved the tearing down of an old mill and putting up a new one, the new one was ordered. What Mr. Schwab thought should be done was done. As a result of such progressiveness we may see the splendid mills at Homestead, where they produce with about 4,000 men three times as much steel as the Krupp works produce with 15,000 men. The results are simply wonderful. You can start there to-day, in a building containing steel-melting furnaces, and you will there see three men mounted on a car with the charging apparatus which is moved and operated by electricity. With a few movements of this ingenious contrivance three men charge twenty furnaces, which prior to the use of electricity would have required the labor of over 200 men.

"You may go into the yard of the Homestead mills where they pile the metal in stock. This yard is covered by a system of overhead cranes, and the result is that not only here, but in the mill and in every other place, you may see great weights lifted and many undertakings going on without a single man exerting himself a bit—working not half as hard as I am working now. (Laughter.)

"I took some English friends to Homestead. Mr. Schwab, after guiding us through several departments, said: 'I will now show you where we turn out 750 tons of plate girders per day.' The mill was in the shape of an 'L.' We went into the short end of the 'L,' where the furnaces were fed by natural gas, of course requiring no stokers. The end at which we entered had a rather low roof, and there was in sight a contrivance like a battering ram in front of the furnaces; two workmen were sitting down eating their dinner near by; no one else was present. I thought, 'Mr.

Schwab has made a mistake; he has asked us to see a mill that is not in operation.' But we went through the mill, which was about 200 feet long, and suddenly we heard a rattle and then saw a truck approaching loaded with a big ingot. No one touched the truck or the ingot. The load came to a platform, the crane overhead dropped a pair of tongs and quickly put the ingot on the roller table, and as it moved along to the great rolls it was automatically kept in place. The adjusting screws of the rolls were turned by little electric motors, and not a man in that house did a bit of work. It was just as easy as what you are doing now—looking on! (Laughter.) We went back to the furnaces. There was a fifteen-year-old boy seated in a little place called the 'pulpit.' He was able, merely by the movement of levers, to open at will any of the furnace doors and move the car along. And we saw this car come in front of a furnace and the charging machine approach and take out of the open furnace a hot ingot which was dropped on the car and moved off to its work. There was this boy doing absolutely no hard work, and his mill was turning out 750 tons of steel plate each day. My English friends said: 'England has no chance in competition with such methods.'

"Now all this sort of thing came about in America because of our necessities. We hadn't men enough to do our work. There was a premium in favor of those who could invent machines to work and thus supply the deficiency.

"At the Carnegie mills we went to see three blast furnaces. They were making 1,800 tons of pig-iron in twenty-four hours. We saw only two or three men on a truck which was moved automatically. These men were letting the ore run from shoots and mixing it in the required quautity, and when they had filled a truck, it was carried up and its contents dumped into a furnace whence it returned for another load. They were running the metal into an immense receptacle into which the metal from all three furnaces was mixed. From this place the metal was taken as required, put into a special tank, mounted on a car and taken to Homestead, two or three miles away, to be poured into the furnaces; one heating only was required.

"I refer to all this simply to illustrate the immense advantages we have had in America, and the kind of experience I have been able to bring to this country, and to which Lord Kelvin so generously alluded, and which I hope will be not only useful and profitable, but will establish for the company I represent a name and a position which you will all regard as most satisfactory. (Applause.)

"I want to thank you very sincerely for the kind expressions with which you have greeted me, and especially for your acceptance of my invitation to inspect this evening a couple of inventions, one of which—the Hewitt mercury vapor lamp—is a complete and accomplished thing. The rays of this light are not very pleasant as yet, but the light is likely, however, to be of great value. The other invention—the Hewitt Static Converter—is quite new, and its object is to convert alternating currents into direct current at so low a cost in comparison with the sums which have heretofore been expended for equivalent results, that it is likely, when fully perfected, to cause an immense stimulus in regard to the use of electricity in all parts of England, and particularly in the agricultural parts of the country, for farm work, and for moving all kinds of vehicles.

"I have taken advantage of these inventions to invite you to see them as my guests, and I thank you for having honored me with your presence tonight."

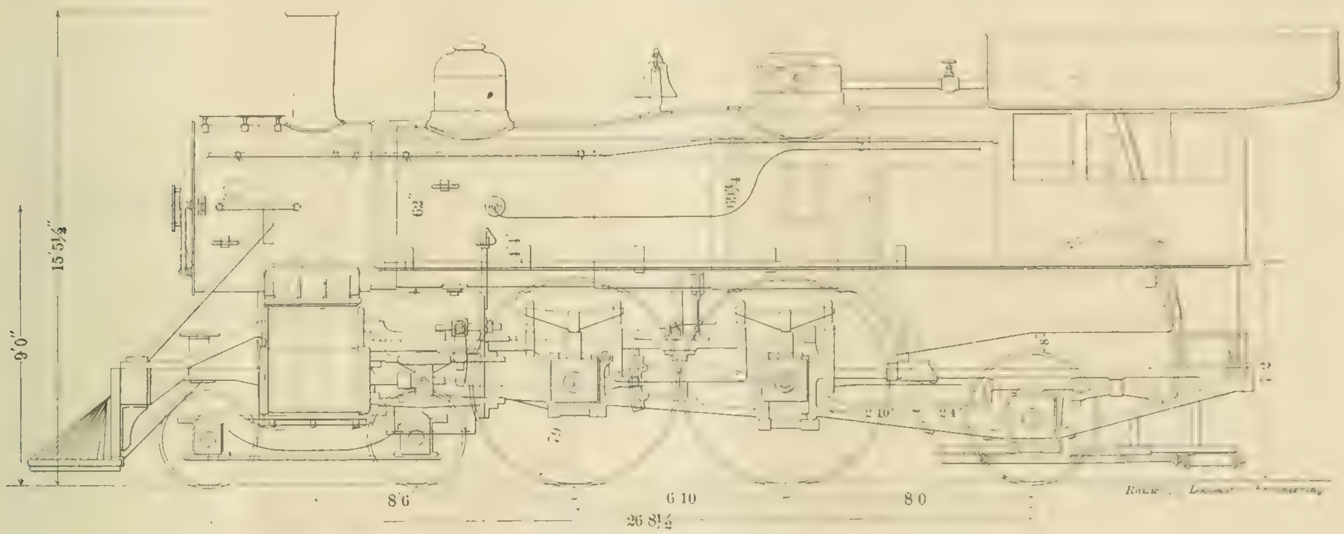
Baldwin Engines for the Norfolk & Western Railway.

The Norfolk & Western have recently received some passenger engines of the Atlantic or 4-4-2 type from the Baldwin Locomotive Works. The engines are simple, with 19x28-in. cylinders, 79-in. driving wheels and an estimated adhesive weight of 84,000 pounds, and with 200 pounds pressure in the boiler, the calculated tractive force is about 21,700 pounds.

The frame of this engine is continuous and the carrying wheels at the rear have inside journals and are equalized with the drivers. Semi-eliptic springs are used all through, and the equalization of the weight on the carrying wheels is similar to that which we illustrated in connection with a 4-4-2 engine on the Central Railroad of New Jersey in our December, 1902, issue. The rear spring hanger of the driver and the forward hanger of the carrying wheel on each side are attached to the ends of a trough-like steel casting. This casting is between the bars forming the frame, and contains a spring, the buckle of which, bearing up against the lower side of the top from member, acts as the pivot point of the system. By shifting of the position of this spring the weight on drivers may be altered as desired.

The motion in this engine is indirect, with transmission bar curved below the axle of the leading driver and the valves are of the piston type. The crosshead is the usual two guide-bar type keyed through the rod. The boiler is of the radial stayed wagon-top type and measures 62 in. at the smoke-box end. The total heating surface is 2,883.9 sq. ft. and the grate area is 45.9 sq. ft. The ash pan hopper doors are operated by air. The tender carries 10 tons of coal and 6,000 gallons of water and the frame is made out of 10-in. steel channels.

Through the courtesy of Mr. W. H.



FAST PASSENGER LOCOMOTIVE FOR THE NORFOLK & WESTERN.

Lewis, S. M. P. of the Norfolk & Western, we are are able to present the above facts and figures. Some of the principal dimensions are given below:

Driving wheel base, 6 ft. 10 in.
Rigid wheel base, 14 ft. 10 in.
Total wheel base of engine, 28 ft. 8½ in.
Total wheel base of eng. and tend., 53 ft. 9 1/16 in.
Weight on leading wheels, estimated, 38,000 lbs.
Weight on driving wheels, estimated, 84,000 lbs.
Weight on trailing wheels, estimated, 41,000 lbs.
Total weight of eng. in working order, 163 000 lbs.
Total weight of engine and tender, 273,000.
Diameter of driving wheels, 79 in.
Diameter of carrying wheels, 50 in.
Diameter of truck wheels, 36 in.
Height of center of boiler above rail, 9 ft.
Height of top of stack above rail, 15 ft. 5½ in.
Greatest width over all, running board, 10 ft. 6 in.
Cylinders, 19 in. x 28 in.; steam port, width, 1⅝ in., exhaust port, wdh., 2⅛ in.; bridge, wdh., 1⅞ in.
Valves, diameter, 9½ in.; steam lap, 1⅛ in.

BOILER

Thickness of sheets, ⅝ and 11/16 in.
Firebox, width, 64¼ in.; length, 8 ft. 3 15/16 in. depth, 73½ in. front; crown sheet thickness, ⅜ in.; tube sheet, ½ in.; side sheet, ⅜ in. back sheet, ½ in.
Water space, width, 4 in. front and back, 3½ in. sides.
Tubes, Number, 326. dia., 2 in. O.D., 110 T. length, 16 ft.
Heating surface, Tubes, 2,718.9 sq. ft.
Heating surface, Firebox, 165 sq. ft.
Heating surface, Total, 2,883.9 sq. ft.

European Railway Notes.

The construction of larger and more powerful locomotives for the British railways promises to continue during 1903. The advantages of working heavier trains has become apparent to managers and the motive power departments are consequently receiving instructions for increased haulage.

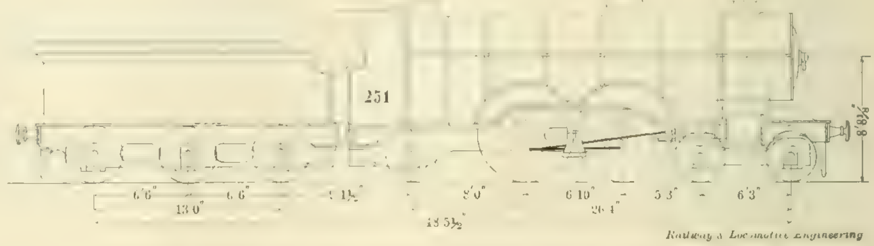
The Great Eastern Railway of England are building some six-coupled radial tank locomotives at the Darlington shops with 55-in. coupled drivers and cylinders 18½x26-in. stroke.

Larger freight cars are rapidly coming into use on several lines having considerable mineral traffic and we illustrate the latest type built for the N. E. R. by the Leeds Forge Company. In the experimental test the car was loaded with 40 tons of coal and 60 tons of pig iron, the deflection of the underframe at the center was then less than an eighth of an inch. Fifty of these cars are on order to be constructed of pressed steel throughout, the length over buffers is 39 ft. and the width 8 ft. The side doors are of the hinged type. When the pig iron, placed on for testing, was removed the remaining 40 tons of coal was discharged in 37 seconds through the hopper doors underneath. These cars show a saving in tare of 40 per cent. and in train length of 50 per cent. when compared with the ordinary small cars now used.

The Great Northern Railway has just built at the Doncaster shops a ten-wheel locomotive of the No. 990 class, with a much larger boiler, the diameter of the barrel being 66 in. and the length 16 ft. The center is 8 ft. 8½ in. from the rail level; the heating surface of the tubes is 2,359 sq. ft. and of the firebox 141 sq. ft. The tender is of the standard type and is provided with a scoop for picking up water.

On January 1 the G. N. R. began an accelerated service of new vestibuled-car trains between London, Leeds and Bradford. Four coaches make up the "breakfast" car trains, accommodating 28 first-class and 99 third-class passengers. The down train leaves King's Cross terminus at 7.15 A. M. and arrives at Leeds at 11.15 A. M. and Bradford 11.28 A. M. The corresponding up train leaves Bradford at 6.45 A. M., Leeds 7.10 A. M. and reaches King's Cross at 11.45 A. M. The down "luncheon" car train is heavier and consists of six cars; it leaves King's Cross at 1.30 P. M. and reaches Leeds at 5.12 P. M. and Bradford 5.28 P. M. These times, viz.: 3 hours and 35 minutes, for the 186¼ miles, are the shortest between London and Leeds by any route. Each car runs on two six-wheel trucks and is fitted with Pullman vestibules and platforms, automatic couplers, Gold's steam heat and gas light. The new engines and cars used on the service have been built at the company's shops to the designs of Mr. H. A. Ivatt, the chief locomotive engineer.

The London, Brighton & South Coast Railway has had running for some time on local and mixed traffic services several new six-coupled radial tank locomotives with 60-in. wheels. This railway is experimenting largely with Texas oil fuel and has erected a large store tank and pumping plant at the West End locomotive depot at Battersea; various types of engines are being fitted, including some of the latest express locomotives. For some time the popular "Pullman Limited," from London to Brighton on Sundays, has been covering the distance of 51 miles in the hour. On December 21 a very fast run was made with this train, the distance being completed in 53½ minutes, the engine hauling the train being one of the latest four-coupled expresses No. 70 "Holyrood."



4-4-2 TYPE ENGINE FOR G. N. R. OF ENGLAND.

The Great Western Railway's new French four-cylinder de Glehn compound locomotive, which will not be delivered until next June, will be in general design similar to the 10-wheelers of the Northern Railway of France, with fittings and cab after the G. W. R. standard.

The Midland Railway, having found its latest non-compounds with Belpaire fireboxes very efficient on the fast Scotch traffic, has ordered a further ten at the Derby shops.

Experiments are being made by the North British Railway Company with a view to displace the wire rope working of trains up the Cowlairs incline out of the Queen street terminus, Glasgow; some powerful six-coupled side tank locomotives known as the 795 class have been built for the work.

EASTERN OF FRANCE, DE GLEHN 4-CYLINDER COMPOUND.

Messrs. Robert Stephenson & Co., the famous locomotive builders, have recently turned out the first engines from their new shops at Darlington. These are four-coupled express locomotives, with 78-in. drivers, built for the Oudh and Rohilkund Railway in India.

The Metropolitan (underground railways of London) will, it is anticipated, have some of its electrified sections

working during the present year. The new trains consist of seven cars, of which three have motors working on the multiple unit system. The total length of the train is 352 ft. and the seating capacity 330 passengers; the central couplers and arrangement of platforms, gates, etc., are operated in a similar manner to those of the Central London Railway and Manhattan Elevated in New York.

In consequence of electric car competition several British railways are seriously investigating the possibilities of motor car services and the North Eastern Railway Company has decided to introduce in certain districts "autocars" where the traffic demands a quick and frequent service. The experiment is to be tried between Hartlepool and West Hartlepool, and an order has been placed with the Motor Power Company, of Coventry, for a number of four-cylinder petrol engines of 85 brake horse power, driving a dynamo which will in turn impart motion through motors to the car. Each car will be self-contained, a full complement of passengers being 52. If the efforts proves successful similar steps will be taken to meet street car competition in other areas. It has already been determined to utilize autocars for special trains in place of steam locomotives.

The London, Brighton & South Coast Railway Company are at present also considering this innovation on a section of their line between Tunbridge Wells and Horsham.

In France, the Paris, Lyons & Mediterranean Railway has the matter under consideration for branch lines, and in the event of their adoption the vehicles will be of the Gardner and Serpollet type.

The law suit brought by the Taff Vale Railway Company against the Amalgamated Society of Railway Servants in connection with the strike on that railway in August, 1900, was concluded after 13 days' hearing on December 19 last. The jury found that the defendants authorized and assisted in carrying out the strike by unlawful means and persuaded men whose notices had not expired to break their contract. The question of damages, which is expected will be heavy, is to be settled at the next sitting. This result has struck consternation among the men's leaders, and various proposals are suggested to counteract the damaging effect on all trades unions.

The Midland Railway Company are building a large new station at Nottingham, six additional tracks have been laid and the main line platforms increased in number from three to six, with a total length of 1,000 ft. The general arrangement of the buildings will be similar to that of the same company's station at Leicester.

The Minho Douro Railway of Portugal have just received from the Hanover Works at Linden some six-coupled passenger locomotives with trailing wheels and outside cylinders. The boiler, which gives a heating surface of 1,455 sq. ft., has a Belpaire firebox, with a grate area of 21.4 sq. ft., the working pressure being 160 pounds per sq. in. Equalizing beams are used for the center and rear drivers and sand is brought to the front of leading and center wheels. Dust shields are bolted on to the frame to keep the motion clean. The engines weigh, when empty, 95,956 pounds, and when ready for the road 107,240 pounds.

Messrs. Maffei & Co., of Munich, Bavaria, have recently delivered to the Eastern Railway of France several new locomotives of the ten-wheel type having a leading truck and six-coupled drivers. The locomotives are compounds on the de Glehn system, with two high-pressure cylinders outside the framing, and two low-pressure, inside. In general design these engines are similar to the series built by the Eastern Company, but they also embody several novel features. The valve motion is of the Walschaert type. The principal dimensions are: Cylinders, high-pressure, 13 3-4 by 32 in.; low-pressure, 21 1-2 by 32 in.; truck wheels, 36 1-4 in.; coupled drivers, 69 in.; boiler, center above rails, 99 1-2 in.; mean dia. of barrel, 59 1-2 in.; length between tube plates, 156 1-2 in.; firebox shell length,

FIFTY TON ENGLISH STEEL CAR.

107 in.; copper firebox length, 97 3-4 in.; width, 3 1-2 in.; total bearing surface, 2,227 sq. ft.; working pressure, 220 lbs. per sq. in.; weight of engine in working order, 149,757 lbs.

At the late Dusseldorf Exhibition there were exhibited several interesting locomotives. The Hohenzollern Works sent a fireless shunting engine which receives its steam from a stationary boiler, one charge lasting several hours.

By the same firm was also shown a Mogul locomotive for the Prussian State railways used for either goods or passenger traffic, having 20 1-2 by 26-in. cylinders. The engine is provided with a Schmidt's patent superheater, Schifer's air-brake and the Langor Narcotty smoke consumer. The Humboldt Locomotive Works at Cologne also exhibited a Mogul engine for the Prussian State railways, having 4 ft. 6 in. drivers and 19 1-2 by 26-in. cylinders.

A fine compound tank locomotive was shown by Mons. Arnold Jung, of Jugenenthal, near Kirchen, for a meter gauge track. Four cylinders are provided, each driving two pairs of wheels.

The visit of English railway officials to the United States last year has impressed some persons with the possibility of modification and improvement in some methods here, and a recent lecture by one of the members of the deputation, Mr. Butt, of the North Eastern Railway, has proved valuable. While admitting the possibility of reform in many matters, the gentleman in question, like his colleagues, is of opinion that generally English methods suit England best, while American ways are essential in America. The revolt of some of the stockholders of the London and North-Western Railway is to be attributed to the very conservative management of the company and the next meeting in February is looked forward to with considerable interest. Foremost among the demands of the reformers is a desire for more explicit accounts, not an unreasonable one we would think, and an investigation of better means for handling traffic.

Yellow Jack Delays Hiring of Railroaders.

Our correspondent, Mr. W. D. Holland, who is now superintendent of the Guayaquil and Quito Railway Company, at Duran-Ecuador, writes us: "I thank you for the "ad." to mechanics and engineers. I received a good many replies and have engaged some to come here, but just not at present, as yellow jack is raging, but in a few weeks will die out. I hope I don't want to get the men here and have them die on my hands, so I will wait until cooler weather shows up. I will write up this road and country for you one of these days, but at present I am busy in the shops day and night, so don't get the time to put my mind on an interesting article for you."

This will explain to parties who have written for positions why it is that they have not been requested to report themselves at Duran-Ecuador.

Recently a loving cup was presented to Mr. John W. Duntley by the members of the sales department of the Chicago Pneumatic Tool Company at a banquet held in the Union League Club, Chicago. At the same time Mr. W. O. Duntley, who is vice-president of the company, was also presented with a handsome gold match case set with diamonds. Speeches were made by Messrs. J. W. and W. O. Duntley in grateful acknowledgment of the gifts, in which they thanked the representatives of the company for the hearty support given them, and the good showing made in 1902, the company having doubled the business of the previous year. Altogether a very pleasant evening was spent.

The H. K. Porter Co., of Pittsburg, have been particularly busy during these rush times and have built a good many locomotives larger than their general design. They are working on a contract for locomotives for a railroad in Costa Rica, the track gauge being forty-two inches. Aside from its heavy domestic trade for locomotives for mining opeartions, narrow gauge roads and for their special services, the production of the Porter Company has gone to nearly every country on the globe. In 1902 the company shipped eight engines to Spain. These were of the usual European standard, although not nearly so powerful machines as the standard of American railroads.

Japan, Australia, South Africa, Russia and practically all the European countries, various States of South America and Canadian provinces have received numbers of the Porter Company's locomotives.

The Philadelphia Pneumatic Tool Company, of Philadelphia, have issued two publications relative to their specialties. One is concerned with the Keller pneumatic tampers—the tool that knows enough to pound sand. These machines, originally made for foundry purposes, are now used in smelting plants and in Bessemer steel works. They are used for tamping the linings and bottoms of converters of all kinds. The other publication is on the care and use of pneumatic tools, in which directions for cleaning, oiling, repairing and using the Keller tools are set forth at some length. The company will be happy to send either or both these publications to any one interested enough to apply.

One completed locomotive every four hours is the present product of the Baldwin works, and as this concern is working night and day with a double force of men, it is able to deliver six locomotives each day to its urgent customers. President Converse says: "The demand for motive power by the railroads does not slacken and we are doing the best we can to meet the needs of our customers by working continuously throughout the twenty-four hours." The Baldwin works now employs 13,000 men. This company's largest customer is the Pennsylvania Railroad, which placed an order for 350 locomotives a short time ago.

The Philadelphia & Reading people have a good, quick way of making eccentric straps. In the first place, the straps are cast solid, and it is said that some amusing speculations have been indulged in by visitors to the shops when first shown a solid strap. The holes for the bolts which will eventually hold the two half-straps together, are drilled through the solid lug, that operation avoids the time and work of setting the straps true with each other. The solid strap is then sawed in two, a stamped liner, the thickness of the saw blade is inserted, the two parts bolted together and the strap is bored out in a lathe. The P. & R. keep liners of varying thickness on hand and adjust for wear by removing the liners already in place and putting in two thinner ones.

We are informed that the name of the Standard Traction Brake Co., of 26 Cortlandt street, New York city, has been changed to the Westinghouse Traction Brake Company. This company sells all the power brakes for street railway service manufactured by the Westinghouse Air Brake Company, including straight or automatic air-operated brakes, with axle-driven or motor-driven compressors, the storage system of air brakes, and the Westinghouse combined magnetic brake and electric car-heating apparatus.

The Central Railroad of New Jersey some time ago had been suffering from what one of the officials of the mechanical department described as a perfect epidemic of broken cross-head keys. The keys which failed were composed of machine steel, but they constantly sheered and allowed cross-head and piston-rod to part company with disastrous results. A remedy was tried in the use of the best spring steel, forged at a low heat and allowed to cool in the air. The remedy proved to be what doctors would call a specific, and the epidemic disappeared entirely. Even if the keys should be given a low degree of temper in the making the satisfactory results now obtained are in no way interfered with.

Of Personal Interest.

Mr. S. B. Mason has been appointed chief clerk to the general superintendent of motive power of the Baltimore & Ohio Railroad.

Mr. W. D. Hall has been appointed electrical engineer of the Grand Trunk Railway system, with headquarters at Montreal, Que.

Mr. G. H. Dryden has been appointed one of the two signal inspectors on the Baltimore & Ohio, with headquarters at Baltimore, Md.

Mr. S. R. Payne has been appointed trainmaster of the western division of the New York Central Railroad, with headquarters at Syracuse.

Mr. W. J. McGee has been appointed acting master mechanic on the Atlantic Coast Line, at Montgomery, Ala., vice Mr. J. F. Enright, resigned.

Mr. J. H. Middleton, until recently secretary of the Erie Railroad, has been elected second vice-president of the Lehigh Valley Railroad Company.

Mr. G. Mudd has been appointed division master mechanic on the Wabash Railroad, with headquarters at Moberly, Md., vice Mr. S. Cooper, resigned.

Mr. R. H. Gilmour, formerly superintendent of the Canada Foundry Company, of Toronto, Ont., has been appointed superintendent of the Brooks plant.

Mr. John R. Gould has been appointed master mechanic of the Clifton Forge division of the Chesapeake & Ohio Railroad, with headquarters at Clifton Forge.

Mr. M. Hickey, master mechanic on the Northern Pacific, at Seattle, Wash., has been transferred to Spokane, Wash., as master mechanic, succeeding Mr. W. Moir.

Mr. George Geiger has been appointed trainmaster of the second district, Rio Grande Western, with headquarters at Grand Junction, vice Mr. E. H. Williams, transferred.

Mr. George Hay, formerly traveling engineer on the R., W. & O. division of the Central-Hudson road, has been appointed foreman of engines, with headquarters at Albany, N. Y.

Mr. R. T. Shea, formerly of the Schenectady shops, has been appointed superintendent for the Montreal Locomotive and Machine Company at Longue Pointe, Canada.

Mr. R. W. Taylor has been made one of the signal inspectors on the Baltimore & Ohio Railroad, with office at Baltimore, Md. There are two signal inspectors on this line.

Mr. G. S. Wood has lately been appointed special traveling representative for the Boston Belting Company. This concern has as its Chicago office 209 Great Northern Building.

Colonel Prout.

Colonel H. G. Prout has severed his connection with the *Railroad Gazette*, to become vice-president and general manager of the Union Switch and Signal Company, of Swisvale, Pa. Colonel Prout has been for the past sixteen years editor of that journal, and has been an able successor of Dunning and of Forney. In early life Henry Goslee Prout served in the Army of the Potomac and went through the Wilderness campaign, the operations which led to the investment of Petersburg and the pursuit of Lee. In 1868 he entered the service of the Khédive of Egypt as major of engineers. He served with distinction in the Egyption army, and rose to the rank of colonel on the general staff. He was, at the request of General Gordon, sent to the head of the Nile as Governor General of the Provinces of the Equator, and during his administration he retained the warm friendship and confidence of Gordon. On one occasion when marching with an expeditionary force across the desert from Suakim to Burber, he was struck with the commercial value of the route for a railway, and he made a careful barometric profile and report to the Egyptian authorities. It is now the intention of the government to build a line over practically ground indicated years before by Colonel Prout. We are only able to give in barest outline these few facts concerning a man who has been successfully, engineer, soldier, governor and editor. He now joins the service of a company which grew out of one with which he was formerly connected as signal engineer. The best wishes of his many friends go with him.

COL. H. G. PROUT.

Mr. C. C. Edwards has been appointed acting master mechanic of the W. M. & P. division of the Chicago Great-Western, with headquarters at Red Wing, in place of Mr. Gregory, resigned.

Mr. George W. Seidel, for a number of years master mechanic of the Lehigh Valley at Buffalo, has been appointed master mechanic of the Birmingham division of the Southern system.

Mr. J. A. Johnson has been appointed signal engineer of the St. Louis Merchants' Bridge Terminal Railroad and Terminal Association, of St. Louis, vice Mr. W. K. Wuerpel, Jr., resigned.

Mr. J. J. Bayly, formerly master mechanic of the Norfolk division of the Southern Railway, has been transferred in a similar position to the Memphis division, vice Mr. N. W. Elliot, resigned.

Mr. M. B. Cutter has been appointed general superintendent on the Lehigh Valley Railroad, with office at South Bethlehem, Pa. The office of Superintendent of Transportation has been abolished.

Mr. B. P. Myers has been appointed general foreman on the International & Great Northern, at Houston, Texas. Mr. Myers was for the past ten years one of the foremen at the Erie shops at Huntington, Ind.

Mr. F. S. Kelly has been appointed general foreman at Longview Junction of the Texas & Pacific, vice Mr. G. M. Lovett, promoted. Mr. Kelly was until promoted foreman of the erecting shop at that point.

Mr. Charles W. Lee, formerly road foreman of engines, has been appointed master mechanic of the Norfolk division of the Southern Railway, with headquarters at Lawrenceville, Va., vice Mr. Bayly, transferred.

Mr. Harry Oviatt, formerly air brake inspector on the New York, New Haven & Hartford Railroad, has been promoted to the position of road foreman of engines on the same road, with headquarters at New Haven.

Mr. H. H. Warner, formerly shop superintendent of the Northern Pacific, at Seattle, Wash., has been appointed master mechanic of the lines north of Seattle, with headquarters at that point, vice Mr. M. Hickey, transferred.

Mr. J. H. Dull has been appointed trainmaster of the fourth and fifth districts of the Eastern division of the Grand Trunk Railway, with headquarters in Montreal, vice Mr. W. W. Ash-

ald, who has been assigned to other duties.

Mr. A. J. Dunn has resigned the position of master mechanic on the Atlanta, Knoxville & Northern Railway, to accept a similar position on the Virginia & South-Western Railway, with headquarters at Bristol, Tenn.

Mr. Daniel Willard.

In our January issue we published the text of a beautifully illuminated address presented on behalf of the firemen of the Erie and other railroads to Mr. Daniel Willard, general manager of the line, as evidence of their appreciation of courtesies extended to their order. That was more than a mere formality, for Mr. Willard is one of the most popular officials in charge of railroad men. His many friends will be pleased that he has taken another step up the official ladder, having been on January 28 elected first vice-president of the company. Mr.

MR. DANIEL WILLARD

Willard is a Vermonter, a proud boast, which in any other country would be equivalent to saying that he is a Highlander. He worked his way upward through the mechanical department, was fireman, engineer and travelling engineer, and always first class of every grade. There was no accident connected with his advancement. Every step was earned by hard work and careful preparation.

Mr. E. H. Williams has been appointed trainmaster of the first district of the Rio Grande Western Railway, with headquarters at Salt Lake City, vice Mr. George F. Cotter, resigned to accept service with another line.

Mr. C. H. Terrell, heretofore general foreman of the machine department of the Chesapeake & Ohio, at Richmond, Va., has been appointed master mechanic on the same road, at Covington, Ky., vice G. W. Hepburn, resigned.

Mr. C. D. Vanaman, one of the oldest engineers on the Florida East Coast Railway, has recently been appointed to the position of master mechanic on the same line, with office at St. Augustine, Fla., vice Mr. G. A. Miller, promoted.

Mr. E. H. Symington, formerly assistant superintendent and mechanical engineer of the Kilbourne and Jacobs Manufacturing Company, has gone into the railway supply business with the firm of T. H. Symington & Co., of Baltimore, Md.

Mr. G. M. Lovett, formerly general foreman at Longview Junction, on the Texas & Pacific Railway, has been appointed master mechanic of the Transcontinental division of that road, with headquarters at Texarkana, Texas, vice Mr. William Laing, deceased.

Mr. George A. Miller, formerly master mechanic on the Florida East Coast Railway, has been given enlarged powers and responsibility on the road, with the change of title from master mechanic to that of superintendent of motive power and machinery. His headquarters are at St. Augustine, Fla.

Mr. Robert Potts, the retiring master car builder of the Michigan Central Railroad, was recently presented with an address and a few gifts at St. Thomas, Ont., by the employees of the department, with which he had been identified. Mr. Potts has been an old and valued official on the M. C. R. R., and retires retaining the highest regard of both officers and men.

Mr. John Roach, engineer on the Columbus division of the Pittsburg, Cincinnati, Chicago & St. Louis Railroad, has been appointed assistant road foreman of engines on the same road, with headquarters at Carnegie, Pa. Mr. Roach will have jurisdiction over the Washington, Pa., branch, also the Bridgeville and McDonald branch, and the Western Washington Railroad and the Carnegie yards.

Mr. Joseph J. Williams, of Dennison, Ohio, has been appointed assistant general foreman of the Dennison shops of the Pan Handle. Mr. Williams served his apprenticeship in the shop of which he is now an officer. At one time he held the position of night round-house foreman, after which he was appointed locomotive inspector for the Pennsylvania company's lines, having charge of new work done in outside locomotive building establishments.

Mr. George H. Gibson has resigned his position with the Westinghouse Companies' Publishing Department of Pittsburg, Pa., to accept a position with the B. F. Sturtevant Company, of Jamaica Plain Station, Boston, Mass., the well-known manufacturers of blowers, heating, ventilating and forced-draft apparatus, electrical machinery and steam engines. Mr. Gibson was formerly a member of the editorial staff of the *Engineering News*, of New York city, and is a graduate of the Engineering School of the University of Michigan.

Mr. William Reed, formerly of the Rogers works, and more recently appointed superintendent of the Brooks works of the American locomotive company, at Dunkirk, N. Y., notice of which appeared in our personal column last month, has been promoted to be assistant superintendent of the American Locomotive works at Schenectady, N. Y. Mr. Reed is a Paterson, N. J., boy, a graduate of the high school, and learned the locomotive business at the Rogers works, rising there to the assistant superintendency.

Mr. M. K. Barnum.

Mr. M. K. Barnum has been appointed superintendent of motive power and equipment of the Chicago, Rock Island and Pacific, succeeding Mr. G. F. Wilson, resigned. Mr. Barnum is best

MR MORGAN K BARNUM.

known to the railroad world through his connection with the Union Pacific as master mechanic in charge of the shops at Omaha. He was celebrated as a particularly efficient shop manager, and co-operating with Mr. McConnell, introduced so many labor saving appliances that the shops were examples that were imitated all over the country. For the last few months Mr. Barnum has been assistant superintendent of motive power of the Southern Railroad. He possesses the very useful faculty of getting on well with men of all grades, which will stand him in good stead with the vast variety of men who will now be under his charge.

Mr. George Gregory, who it was said had resigned from the Chicago Great Western, has not resigned, but holds the position of master mechanic of the W. M. & P. division on that road, which position he has occupied since last November. At the time of his appointment he was also made acting master mechanic of the Mason City & Fort Dodge division. The transfer of Mr. T. H.

York from the Eastern division of the Chicago Great-Western Railway, has only relieved Mr. Gregory of the extra duty which had been temporarily assigned to him.

Mr. Edward W. Pratt has been appointed master mechanic on the Tremont, Elkhorn & Missouri Valley at Missouri Valley, vice Mr. S. A. Teal, retired.

Mr. E. E. Betts, formerly train master on the C., R. I. & P., has been appointed chief clerk to the division superintendent at Boon, Ia., vice Mr. G. H. Steen, resigned.

Mr. Chas. H. Temple has been appointed acting master mechanic of the Pacific division of the Canadian Pacific Railway at Revelstoke, B. C., vice Mr. G. Hall, promoted. Mr. Temple has been on the Pacific Division since it was opened in 1886.

Mr. E. W. Alling, an engineer on the New York, New Haven & Hartford Railroad, has been appointed to the position of air brake inspector on the same road, vice Mr. Oviatt, promoted.

Mr. R. J. Gross, second vice-president of the American Locomotive Company, has gone on a trip around the world. His purpose is to investigate the Oriental countries as fields for locomotives. Mr. Gross is an old railroad man, and he will be quite at home following the investigations he is engaged on.

Mr. Alexander Shields, who was recently appointed master mechanic of the Canadian Northern Railway at Winnipeg, was presented, on leaving the C. P. R., with a magnificent onyx clock, mounted in solid gold by the employees of the round house, and with a solid silver tea service by the C. P. R. engineers and firemen. Mr. Shields resided for many years at Toronto Junction, and was one of the most popular men on the Canadian Pacific.

Mr. J. H. Burns, of Cedar Rapids, Ia., for a number of years master mechanic of the Burlington, Cedar Rapids & Northern, and late of the Northern district of the C. R. I. & P. Ry., was on January 18 presented with a diamond ring as a token of esteem by his former employees. The resignation of Mr. Burns was something of a surprise to all concerned, and deep regret was felt on all sides. He was a loyal officer of the company, but at the same time the interests of his men were never lost sight of by him. The deep feeling of mutual confidence which existed was demonstrated at the presentation and by the universal expression that he was a "grand old man." All ranks on the old B. C. R. & N. unite in wishing Mr. Burns every success in his new position as master mechanic on the Chicago Great-Western, at Dubuque, Ia.

The Reading's New Shops.

A most interesting object lesson in modern railway shop equipment may be had by any one who visits the new repair plant recently established by the Philadelphia & Reading Railway. These shops, situated at Reading, Pa., are to the whole system what the power-house is to the shops. They form the distributing center, and the farthest outlying portions of the road are less than 200 miles from this geographical center.

The power-house is one of the best installations in the country. Tunnels radiate from it for the conveyance of electricity, live steam, exhaust steam, hot and cold water and compressed air. The pipes are fully protected in the tunnels, while all the time they are capable of inspection. The boilers are upright Wickes water tubular, with Roney automatic stokers, and the whole of the coal handling plant was made by the P. & R. C. & I. Company, and is not subject to the interference of weather changes. The Holly system of removing entrained water in separators is used. Exhaust steam heats shops and the Warren-Webster system of returning the water of condensation to the boilers is in operation.

The machine shop occupies 60 ft. of center width of a 740 ft. building flanked by two areas 70x740 ft., in which are arranged the erecting shop pits, 35 pits down each side, placed at right angles to the length of the building. In the machine shop the electric-group plan has been adopted for tool driving. The shafting is in varying lengths, turning in roller bearings with separate motor for each section.

The entrance and exit of engines is effected upon two tracks, one at each end of the shop, and each track terminates at 65 ft. turntable outside. Each erecting shop is served by a Niles 120-ton electric crane of 69 ft. span, with two trolleys. Each shop has also at a lower level a 35-ton crane. The boiler shop has a duplicate 35-ton crane, and as the track of the west erecting shop crane is a continuation of that in the boiler shop. the west side may be said to be served by two 35-ton cranes. If one of these cranes traveled from the upper end of the erecting shop to the lower end of the boiler shop and back, such an excursion would cover nearly half a mile. Over the central portion where the machines are placed, two 10-ton cranes of 55 ft. 10-in. span operate. The tool-rooms are in the center of the shop. The wheel department is immediately north of tool-rooms, the cylinders occupy next place on east side and on the west side the brake work is done. South of the tool-rooms all other machine work is carried on. The main shafting is high up out of the way, while the counter-shafts are supported on cantilevers fastened to the posts. In addition to the other carrying facilities in the shops there are what may be called outriggers from the posts for trolleys for handling rods, etc., with pneumatic hoists. Outside the walls of the shop and covered by lean-tos are four wash-rooms, supplied with hot and cold water. There are also seven Buffalo Forge Fans for heating this building, also placed in lean-tos, so the entire floor space is available for the work of the shop.

The whole building is a well-lighted brick structure, with steel posts and roof trusses, and the clear story is filled in entirely with glass. Between each pit there is a stand or rack for rods, pipes, etc., with broad channels on top to carry cabs when removed from engines. At one end of these racks is a box with five holes for the attachment of the wires of portable electric lights. These lamps are kept in the tool-room and may be obtained by cheque. A pipe is run down each post which supplies gas for the lighting or the heating of work when required. Each pit is supplied with hot and cold water and compressed air. A longitudinal track of standard gauge runs down the center of the machine shop, through the store house and into the receiving yard beyond. The cross track at the north end of the shop, previously referred to as one of the means of affording entrance and exit to engines, communicates with a small adjoining building in which are placed two cleaning vats 10 ft. x 20 ft. x 7 ft. deep. A pneumatic crane, 7 1-2 tons capacity, overhead, lowers or raises smaller parts in baskets while an engine truck or a pair of driving wheels may be dipped into the strong lye and thus thoroughly cleaned before further work is done.

The boiler shop is 400x70 ft., and is continuous with the west bay of the machine shop, as already described. A lean-to 400x50 ft. contains boiler shop machinery, flanging shop, sheet iron shop and flue shop, while the riveting tower is placed near the center of the lean-to. An ample hydraulic riveter, with 17-ft. gap, arranged to give 40, 80 or 120 tons pressure on the rivet, has been installed below crane with hydraulic lift and hand traverse, which is 63 ft. above the floor. The operator stands on a staging attached to the riveter, with extension floor which can be used as desired. Beside the riveter is a flange press of the latest pattern. It has a capacity of 560 tons. It is constructed with a main ram to raise the center table, with internal ram for use as required. There are also four auxiliary jack-rams working through the center table and there is an auxiliary ram in the top head which is adjustable from the center to two feet to one side. (Water pressure is obtained from a set of triple double-acting pumps, driven by a 100-horse power motor, working at 1,500 pounds pressure in the accumu-

lator.) The tank shop occupies the lower end of the main bay. The tube rattler is contained in a separate building outside the shop so that the noise is not very loud in the main shop. A large wash-room has also been provided, and the heating arrangement is the same system as that employed in the erecting shops.

The storehouse is located between the boiler shop and the blacksmith's shop, within convenient distance of the machine shop, foundry, etc. The floor level is that of a box-car floor for convenience in unloading. Outside are large platforms, for the storage of castings, built up to the same level as a car floor.

The forge and smithy is a long building, each department occupying a floor space of 275 ft. x 60 ft. The forge is next to the machine shop. A lean-to contains six furnaces with waste-heat boiler for the hammers. The furnaces are equipped with blower and exhaust fans to take away smoke with branches from fire holes and doors. The smiths' fires use the Sturtevant down-draft system, and are arranged in three sections, each of which contains blast and exhaust fans. At the south end of the smithy machines, etc., are grouped and operated by an electric motor. The hammers and fires for heavy work are served with jib cranes, while a 10-ton electric traveling crane runs over the entire shop. A standard wash-room is also appended.

The foundry building is 400 ft. x 130 ft. Over the central bay a 10-ton Niles crane is operated. Two Whiting cupolas are placed in front of the blower room in which two electrically driven blowers are installed. An electrically operated elevator for material is in a tower behind, which is accessible from the stock house or the yard. Four five-ton electric jib cranes can be moved to and from any post in the shop, as occasion requires, just as a man might take down a shutter from a window. The northwest corner of the shop is devoted to brass work, machinery for finishing bearings will be installed in the near future. A brass stock room occupies the northwest corner. In the northeast corner is a large room for cleaning castings, in which a pneumatic sand blast will be used. Each side bay of the main shop is equipped with four pneumatic traveling hoists. A wash-room is also attached, with the unique feature that shower baths can be had by the lucky foundry-man employed in the shop, and this is in addition to the hands and face washing facilities which this and all the other Reading shops enjoy.

The stock house for foundry material has depressed narrow gauge track and bins communicating with the electric elevator which runs up to the cupola charging floor.

A building north of the foundry contains lumber storage, carpenter and paint shops, scale department, in which the weigh-scales of the entire road are repaired and adjusted, and the electrical department, all on the ground floor. The woodworking and pattern shops are on the second floor and the third and fourth stories are devoted to pattern storage. Two large outside electric elevators serve this building. Altogether the Reading plant is the largest and probably the most modern railway plant in the country.

To Visit Us.

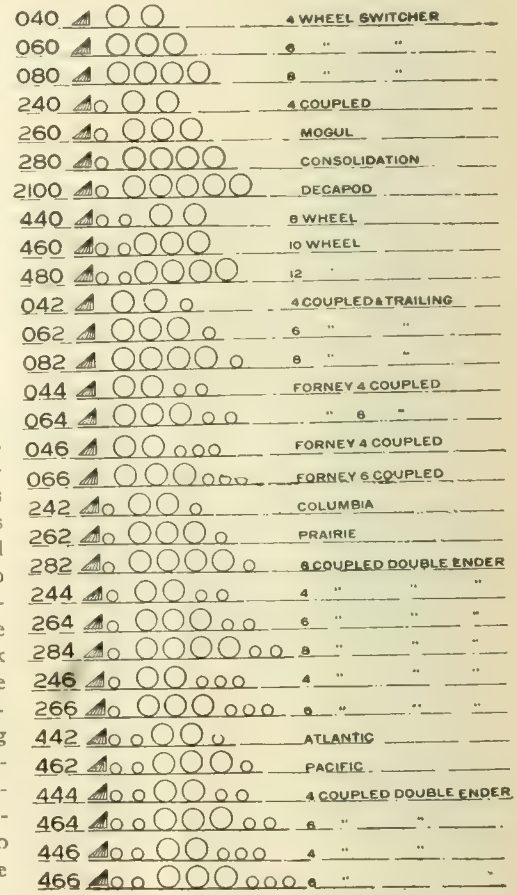
It is reported that a deputation of officials belonging to the London & North-Western Railway are coming to the United States to study our methods of operating railroads. The London & Northwestern have always insisted that their appliances and methods are as nearly perfection as they can be made, and that they were an example for other railways to follow with the assurance that they have safe guidance. We suspect that the deputation will come and look over our railroads and our machinery, then return home and report that they found nothing worthy of imitation.

History of the Baldwin Locomotive Works.

The Baldwin people have just issued a history of the works which has been revised and brought up-to-date. It covers the period from 1831 to 1902, and gives the names and changes in the personnel of the firm from that day to this. A map of the present works with recent extensions and improvements is also to be found in the opening pages. The book forms a very satisfactory review of the advance in locomotive design as exemplified by one of the pioneer building concerns and the largest single establishment in the world to-day. The output of the works is given as 118 locomotives in 1866, and in 1871 it appears to have almost trebled, as 331 engines were turned out that year. The present establishment employs 13,000 men, the principal departments run continually 23 hours a day, the works consume 2,150 tons of coal per week, and on the average turn out an engine every 4 hours and 36 minutes.

Locomotive Classification.

The American Locomotive Company have adopted a system of locomotive classification which is a modification that devised by Mr. F. M. Whyte, of the New York Central. The idea is to eliminate the now almost meaningless type name. Under the new scheme an engine of the Atlantic type, such as the Norfolk & Western passenger, illustrated elsewhere in this issue, weighing in all 163,000 pounds, would be written down as a 442-163. If the engine in question was a compound it would be 442 C 163. If the tank was carried on the main frames the letter T would be placed between the figures indicating the wheel arrangement and those indicating the total weight. The "wheel figures," if we may so call them, may be separated by hyphens, according to "the taste and fancy of the speller," as the elder Mr. Weller said when asked if he wrote his name with a W or a V. Using this modified Whyte system, a heavy compound consolidation engine might be written 2-8-0 C 200, which would mean that the engine weighed 200,000 pounds and was a compound with the wheel arrangement given.



AMERICAN LOCOMOTIVE COMPANY'S SYSTEM OF CLASSIFICATION.

Some sort of system is certainly required, as in at least three instances there have been more than one type name applied to the same kind of engine. Not every one can describe off hand what the difference is between a Decapod and a Mastodon, and to the non-technical public any large engine is a Mogul. The system now in use by the American Locomotive Co. gives one the wheel arrangement, whether the engine is simple, or compound, or one of the tank variety, and it also gives the total weight of the engine itself. After giving this much information, the system might not inappropriately add in the words of the genial showman: "For further particulars see small bills."

Cars for New York Underground Railway.

An order has been given for five hundred cars for the tunnel line, by the Interborough Rapid Transit Company, of which two-thirds are to be motor cars and one-third trailers. Two of these cars, of the parlor pattern, the "John B. McDonald," furnished by the Westinghouse Company, and the "August Belmont," furnished by the General Electric, each equipped with two motors of 200 horse-power, which have been running over the Ninth avenue line, have fully come up to all of the conditions required of them in the various tests to which they were put. A speed of forty-five miles per hour was easily attained in the final test.

The new cars are 50 feet 1 inch in length over platforms and 42 feet 7 inches over car body, about 3 feet longer than the cars of the Manhattan Elevated system. Their width over window sills is 8 feet 11 5-8 inches, 2 5-8 inches wider than the Manhattan cars, and their height from the top of the rail to the top of the roof 12 feet or 10 1-2 inches less than those of the Manhattan.

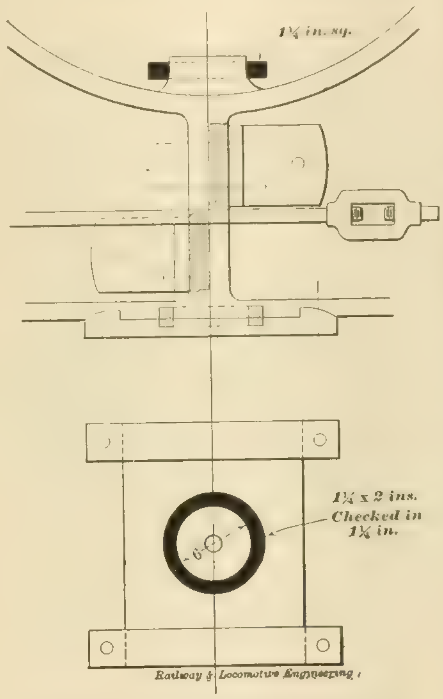
The cars are constructed with the greatest possible strength, in order to insure safety. The longitudinal sills are of compound construction, with center cross trussing between the steel needle-beams. The platform end sills are of steel, fitted with heavy steel anti-telescoping plate. The side framing of the car bodies is of white ash, doubly braced and very heavily trussed. The platform posts are of compound construction, with anti-telescoping posts of steel bar sandwiched between heavy white ash posts at corners and centers of vestibule platform. These posts are securely bolted to the steel longitudinal sills and also to steel anti-telescoping plate below the floor and to the hood-bow reinforce, which is of heavy steel angle in one piece, reaching from plate to plate and extending back into the car body six feet on each side.

In case of accident, where one platform rides over the other, eight square inches of metal would have to be sheared off in the posts. The vestibule doors on one car are of the Gibbs type; the side doors are sliding doors arranged to slide into pockets in the side framing, thereby giving up the entire platform to the passengers. The end vestibule door is so arranged that it will close up the passageway between the center vestibule posts, in which position the entire platform is given up to the motorman; in another position the passageway is left open and the door closed to end post of car body, giving the motorman a small compartment of about one-third of the platform; and in the third position the entire platform is given up to passengers while the door shuts off the motorman's brake valve and electrical device.

The floors are double, with asbestos roll fire-felt sandwiched between, and the floor sheathing is of white pine completely covered on the under side with 3-16 inch asbestos "Transite" board. All parts of the car framing, flooring, sheathing and the like are coated with fireproof paint.

Loose Cylinders Made Tight.

A very neat piece of repair work was recently done in the Philadelphia & Reading shops at Reading, Pa. A passenger engine, whose cylinders had "worked" sufficiently to break the front flanges, as shown in our illustration, was very securely patched in the following manner. Two knees were bolted on the front through which flange bolts were



METHOD OF TIGHTENING LOOSE CYLINDERS.

inserted in the usual way, but the most reliance was placed in the bands and straps which were applied elsewhere. The center casting for the engine truck bolts up to the underside of the saddle and is lipped-up on the saddle at both ends in the usual way. This casting had its lipped-up ends planed off so as to make room for two straps which are fitted to the underside of the saddle front and back. These straps are like pedestal binders, and are put in place and bolted up hot, so that the contraction which follows draws the cylinders close together. A further tightening on the under side is effected by boring a circular groove of square section in the center of the saddle. A turned ring 1 1-4 x2 in. in section and 6 in. diameter was dropped in place hot and allowed to cool. The groove being 1 1-4 deep, the ring stood down 3-4 of an inch into the center casting which had been counterbored to receive it. The base for the exhaust pipe, which is part of the saddle, was chipped off on the outside and a 1 1-4 in. square band was shrunk on it. An external band of the same section with a pair of car, truss-rod turnbuckles was passed round the flange forming the base of the steam chest, and this band was heated before the turnbuckles were screwed up, so that it is now probable that the cylinders have permanently given up all idea of working loose again.

A Block Signal Calendar.

The Union Switch and Signal Company, of Swissvale, Pa., have got out a calendar which is simply unique. The date-recording part of it is what is known as a universal calendar which does not become unserviceable with the close of this year, and this handy feature of the calendar is very appropriate, as the use of block signals will grow with the years and will not become obsolete with the termination of any fixed period of time. The attractive feature is that on the card upon which the calendar is mounted there are six movable signals about 3 inches long, made of celluloid and colored "all proper" as engravers of crests would say. They stand out very clearly on the deep maroon background. On the right is the block signal, with home and distant semaphore blade on the same post with continuous light 60-degree spectacles. For night signaling this causes a "stop" or a "caution" light to be displayed until the semaphore blade is within 10 degrees of the "clear" position. This is faithfully reproduced in the beautiful little model, which can be adjusted with the greatest precision in a moment. The models are arranged with the green color as the "clear" indication, the yellow as the "caution," and the red as the well-known imperative "stop." The semaphore blades indicate their character not only by their color, but by their shape. The "home" signal at the top is a square end blade with white band across the red ground. The "distant" fish-tail blade below is colored green and shows a white cheveron like the sleeve badge of a sergeant in the regular army.

Other miniature semaphores use what are called 90-degree spectacles and clearly indicate the correct color displayed when the semaphore blade is in any given position.

We venture to say that this calendar will be found very useful for purposes of instruction, because the arms can be moved just as the real signals along the track move, and the position assumed and the light shown by a possibly defective signal can be simulated on this card with perfect fidelity. Another possible

use the calendar may be put to is in case of controversy about a particular signal at a certain time. The investigating official can bring the men concerned separately into his office and make each one of them place the model in exactly the position in which he remembers the signal in question to have been, at the time he saw it.

Speaking of semaphores reminds us that Charles Dickens, in *Mugby Junction*, amusingly describes the departure of a railway train in England and the "clearing" of the block signals by saying: "Then, prodigious wooden razors set up on end, began shaving the atmosphere." We have only this to add to the great novelist's humor, that the railway signal razors made by the Union Switch and Signal Company are of the "safety" variety, and any railway which desires to have "clear cut features" in connection with its operation ought to apply first for a calendar and then for a complete installment.

Trains to Run 110 Miles an Hour.

Parties interested in the Mona-Rail Electric Express Railway report that they expect to have their system in operation between Liverpool and Manchester during the present year. They also expect to connect London and Brighton with a sort of lightning train service. They talk of making the modest speed of 110 miles an hour, and the places they propose to serve could stand a little acceleration, but they will probably find certain obstacles to that speed which they had not calculated upon.

Experiments that were made in Germany two years ago with electrically driven cars indicated that a speed was soon reached that produced shocks which ordinary track could not endure. A large proportion of the weight of an electric truck has no spring intervening between it and the rail. At moderate speed this unresilient body does not hurt the point of contact very much, but a velocity is reached within the power of electrical traction which hammers the best steel ever produced out of shape very rapidly. We hope the mona-rail people will go on with their 110 miles an hour railway. Its operation will teach people something.

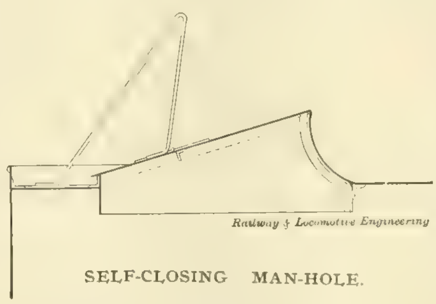
Drawback for Locomotive Material Imported.

Acting Secretary of the Treasury Spaulding has extended the Department regulation of March 31, 1899, establishing a rate for allowance of drawback on locomotive parts known as bars, wrist-pins, stay bolts and piston rods manufactured wholly from imported Taylor iron, as far as applicable, so as to cover the exportation of the same and similar parts including axles manufactured wholly from bar iron at the various works of the American Locomotive Company.

In order to determine just allowances for waste in all cases the drawback entry must show for each part or class of parts exported the weight and value, at the works, of the iron used as imported and of the scrap produced therefrom, the calculations based on such weights and values to find the quantity of iron consumed being as prescribed under the head of "locomotive and railway car wheels," in Treasury decision No. 17,255. The Department regulation above mentioned is amended so as to be subject to the foregoing provision with respect to waste allowance.

Self-Closing Tank Man-Hole.

Some of the fast passenger engines on the Central Railroad of New Jersey have now and then occasioned temporary inconvenience to the baggageman riding in the car coupled to the tender. The way in which this worthy was given "a bad quarter of an hour" was that in scooping water from the track-trough the tank of the flyer would sometimes



SELF-CLOSING MAN-HOLE.

become full to overflowing before the scoop could be lifted. In such a case the water would flow out of the man-hole and pour in great volume against the door of the baggage car, damaging it more or less or forcing it open, and flooding the car floor. The very simple and effective remedy here illustrated was speedily applied. It consists of arranging three light iron brackets behind the hinged man-hole door, which prevents it opening all the way back. The man-hole is 48 in. long and the door or lid is made to stand, when open, at something less than a right angle, and so always automatically drops back and keeps the man-hole shut. When the lid is forced up by the sudden surge of water when the tank overflows, the lid swings back against the supports and compels the water to flow toward the sides of the tank and so to the track without reaching the baggage car door. When the up rush of water subsides the lid falls back to place again as if nothing had happened.

We must fight our way onward. We must be brave. There are obstacles to be met, and we must meet, and crush them.—*David Copperfield.*

A Balanced Engine.

A patent has recently been granted to a New England man for a perfectly balanced engine. It is a compound, with two cylinders between tne frames and two in the usual position. The pistons of these cylinders, by means of piston-rods, crossheads and connecting rods, actuate levers lying in a horizontal plane which are pivoted in the frame. The right outside cylinder and the right inside cylinder operate on the two ends of the right horizontal lever, which works something like the walking-beam of a steamboat. This short horizontal walking-beam has a connection placed between its inner end and the pivot, very much in the same relative position as the condenser pump rods are attached to a steamer's walking-beam. This connection rod operates, that is, rocks, a shaft in the center of the engine, and outside the frame this shaft terminates in a large double-arm rocker. The same description holds good for the other side of the engine, the rocker shaft being made in two pieces works in one central bearing. The balancing is accomplished by making the driving wheels without counter weights, each crank pin being balanced by a hub on the wheel similar to that which contains the crank pin. The large external rocker arm has from each end a connecting rod, one reaching the forward wheel's crank pin and the other reaching the crank pin of the trailer. The pins are so arranged that when the forward crank pin is on the bottom quarter, the pin of the trailer is on the top quarter, and therein the balancing idea has been worked out. Some minor detail for joining the connecting rods with what is called a "yieldable link" has been introduced to compensate for inequalities of the track.

The patent office illustration shows the arrangement applicable to a 4-4-0 engine, and as there are no side rods we do not know how engines of other wheel arrangements would be equipped. This may be a perfectly balanced engine, but it has on each side nine pin connections or pivots which are not found in the ordinary design of locomotive, so that the ability to run hot or develop lost motion by wear of pin or brass with consequent increase of maintenance charges, has been allowed to gain a strong foothold in a design where the usual want of balance may have been successfully eliminated. There is a law of mechanics which says that what is gained in speed is lost in power, or a gain in power means a loss of speed at the business end of any machine. There seems to be a corresponding law of compensation in machine design which, though not perhaps impossible to overcome, is yet exceedingly powerful. The gain in balance in the machine before us is secured at a sacrifice of simplicity

of construction, and the lack of simplicity in design may easily place an otherwise good idea, though carefully worked out, just beyond the dead line which inexorably separates what is mechanically feasible from that which is commercially possible. The car wheel loose on its axle for the purpose of reducing friction on curves is an example of the same kind of thing.

How State Management of Railways Works.

At a moment when some Socialists, more zealous than enlightened and wise, are planning an electoral campaign on the issue of the State purchase of the railroads, it may be useful to point out the disastrous results that have come from the management of the railroads in a European country, Denmark.

The Danish government manages more than half of the railroad system of the country and has no reason to be pleased with the results of its experience. In four years, from 1898 to 1901, the surplus of 4,000,000 francs has fallen to less than 500,000 francs, and that in spite of a steady increase in receipts. For the present year a further diminution is anticipated.

Now, the deciding factor in this situation simply is the introduction of electoral politics into a domain that should have been closed to it.

While the length of the system has continued to be practically the same, the number of employees has increased by 1,400, while their wages have increased steadily. This is apart from the guarantee of interest and subventions, granted at the request of the deputies, to lines managed by private companies.

It might be supposed, perhaps, that in the presence of such a state of affairs the Danish government and deputies are ready to give up these practices. Not at all. To make up for the deficit in the budget of railroads they intend merely to raise all rates for transportation, for passengers, freight, postal packages, even for letters, which amounts to making everybody pay, through the increased rate, for the fancies of a few.

This example should be enough for the advocates of the state purchase of railroads in France.

Safe Transportation.

A recent press dispatch from London says: "Presiding to-day at a meeting of the shareholders of the London and South-Western Railway, H. W. Campbell remarked that if the company did not adopt American methods it was simply because what was termed economy in one country would be rank extravagance in the other. The officers had experimented with large freight cars, and they were found quite unsuited for their requirements.

"Regarding the passenger traffic, Mr. Campbell said that, while the length of the railroads in the United States was nine times greater than those of Great Britain, the latter carried twice as many passengers, or about 18 times as many per mile of railroad.

"The returns of accidents, Mr. Campbell further remarked, were considered unusually instructive. Not a single passenger was killed in Great Britain during 1901, while 249 were killed in the United States that year and 476 passengers were injured in Great Britain in 1901, against 4,129 injured in that year in the United States."

The British Board of Trade figures given in the above comparison were quoted in RAILWAY AND LOCOMOTIVE ENGINEERING in the September (1902) issue. The total number of passengers carried in the United Kingdom in 1901 was 1,142,277,000. Of these 476 were injured, none were killed.

"American methods," when spoken of by well-informed persons in railway circles, are generally held to include financial matters, account keeping, cost-reducing practices, the economical handling of bulk freight over long distances in solid trains, the interchange of cars, etc. These may or may not meet with the approval of the chairman of the London and South-Western Railway, but he is aware of the fact that no sane person can find fault with the system of train movement which could transport more than 25 times the entire population of the British Isles without the loss of a single life. Col. Campbell may justly feel proud of the superb transportation performance of his country, which clearly surpasses what American railroads have so far been able to accomplish, but the methods by which this magnificent result has been achieved are not the methods which he is at all likely to be pressed to reform. The London and South-Western may not care for cost-reducing suggestions from this side, that is, their business, but for ourselves it is the duty of every railroad man in this country from president to engine wiper to work steadily toward such a standard of excellence in operation, as will make American transportation not only the cheapest, but the safest in the world.

ROTARY SNOW PLOUGH BUSY.

"The Book of the Royal Blue."

"The Book of the Royal Blue" for February, which is the magazine published by the passenger department of the Baltimore and Ohio Railroad, is principally devoted to a description of Harper's Ferry and of the John Brown raid, and the events connected therewith. It is written by the editor, Mr. William Elliott Lowes, in a most interesting style, thus making this issue one having historic value. We advise persons interested in the events referred to, to obtain a copy of this number of "The Book of the Royal Blue," which they will find a very good publication to file for future reference. It is very well illustrated with engravings made from photographs taken during the war time.

A correspondent in New South Wales writes: "Other drivers and myself have often found the Detroit lubricator blocked, the oil not going up in the 'sight glasses,' and by shutting off the steam for a few seconds, they have worked all right, and continued to do so throughout the trip."

A Railway Completely Ignores a Large Suburb.

The "unnecessary-ness" of a great deal of locomotive whistling becomes apparent from the following incident, which is a true story: A trunk line entering a large city passed through a suburb, in which there stood a full-sized and beautifully painted semaphore. This signal protected a yard in which considerable switching was done, and the layout of the tracks was such that the main line had occasionally to be used. A pensioner of the road was put in charge of the semaphore, and was given a small shanty, just large enough to contain himself and the regulation caboose stove. The method of operating the semaphore, which soon came into vogue, was that all trains, even regular expresses, used to whistle for this signal, and on hearing the whistle, if the line was clear, the semaphore man lowered the red and white arm. He never looked out for the train, he waited to be "asked" for a clear track.

There are several ways in which this "asking" may be done. There is the long, steady whistle, which seems to say, "Here we are, let us in!" There is also the excited blast, which implies the words, "Now, then, old sleepy, look alive!!" and there is the sudden, explosive, ear-piercing shriek, which, if delivered immediately opposite the signal-light at night, may put it out. This latter sound seems to say, "What the blank are you keeping us here for so blanked long!!!"

Now all this whistling and shrieking had for its object the arousing of one man's attention to the need of the train. By the rules of the road, this semaphore had to be lowered before any train could proceed. By the curiously established custom each train had to whistle for it. By the laws of nature sound is propagated in all directions at an approximate velocity of 1,100 feet a second, and by a combination of all three, about 20,000 law-abiding citizens of the suburb were let into the secret, unwillingly, not once or twice, but many times a day. But, gentle reader, as the ancient Greeks used to say, "the feet of the avenging gods are shod with wool." The city passed a by-law prohibiting all whistling within its limits, except for "cause"—and the signalman forgot.

On the day after this ordinance went into effect, fast express Two Two—Too, approached, slowed down, crept up to the semaphore, and halted without a sound save the "swish" of the air brakes. The train crew waited; then they "got together," and incidentally gave their opinion of the situation in fluent and forcible English, which, by the way, was totally unfit for publication. The brakeman, as a deputation of one, walked resolutely forward over several hundred yards of excellent permanent way and surprised the signalman. The brakeman "used language" and the semaphore was lowered without the knowledge of the 20,000 law-abiding citizens aforesaid.

On the following day the train mail brought a letter to the suburban station which was eagerly read by the side of the caboose stove in the shanty. The letter was signed by the superintendent, and was written in the well-known "I-do-not-for-a-moment - think - you-could-possibly-have-helped-it" style, but it ended with the very familiar, though ominous words, "please let me have your explanation." It is needless to say that the so-called explanation offered was more than exceedingly lame, and fell down badly everywhere it could, but after that, the "regrettable incident," as diplomats say, was considered closed.

Thereafter, the signalman, though old and somewhat infirm, was most surprisingly alert. Trains were not stopped without serious "cause," and 20,000 suburbanites were able to pursue the even tenor of their way in absolute silence as far as the Loud Whistle & Shriek Railway Company was concerned. Thus were the inhabitants totally ignored by the road.

Moral: "Please let me have your explanation" is a powerful formula, even when an experienced man with a searchlight cannot discover the faintest trace of so much as the mere outlines of the thing asked for.

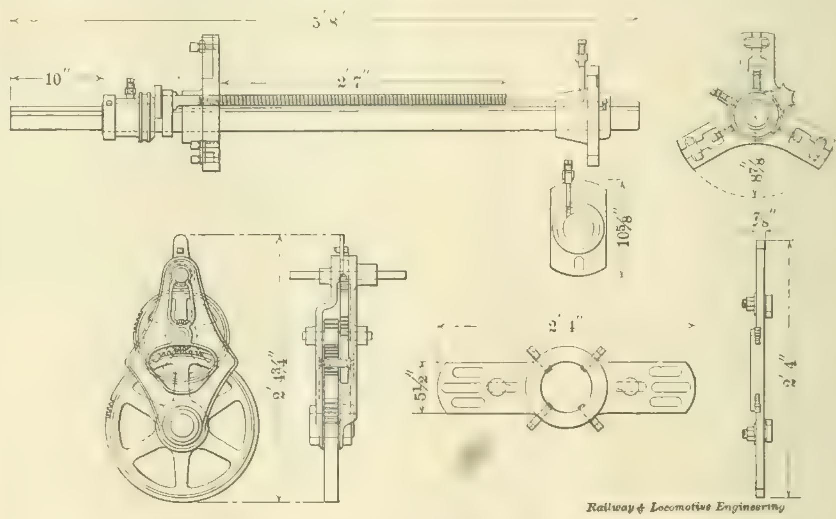
The Rhodes Curry Co. have established car building works at Amhurst, Nova Scotia, and are likely to receive sufficient patronage to build up prosperous works. They are in a position to receive a plentiful supply of timber necessary for car building, which gives them raw material at low cost. They have received orders for about 600 box cars and are expecting an order for ten first-class passenger cars for the Canadian Pacific.

Cylinder Boring Bar.

The accompanying drawing shows a new style cylinder boring bar recently made by Mr. C. D. Higgins, of Boone shops of the Chicago and North Western Railway, for boring out cylinders of locomotives. The advantages of this bar over the old style boring bar is that the cylinders can be bored without removing guides or breast beam. Another advantage is that the shaft is very rigid, so that it carries three tools and in most cases but one cut is all that is necessary to true up a cylinder. In a practical test of the tool made here recently a cut was run through a 20x26 inch cylinder in 1 hour and 50 minutes. The inventor will protect his improvement by patent.

A. B. SILLIMAN.

Boone, Ia.



C. D. HIGGINS CYLINDER BORING BAR. C. & N. W. RY. CO.

Metal Plated Cars for the Interborough.

We have been informed that the president of the Interborough Rapid Transit Company has awarded a contract to the Metal Plated Car and Lumber Company, of this city, for the sheathing of 500 Interborough Rapid Transit passenger coaches with copper sheeting in its natural color. The Interborough Company has adopted the metal-plated car system as its standard. The metal-plated car system was invented in 1899 by W. P. Appleyard, master car builder of the N. Y., N. H. & H., and has been successfully used for several years by a number of steam railroads, among which are the Erie, Fitchburg Division of the Boston & Maine and the N. Y., N. H. & H.; but this is the first time that copper in its natural color has been adopted. Previously it has always been oxidized. The advantages of the metal-plated car system are said to be the protection of wood against fire, saving by the elimination of the cost of painting and varnishing. The saving in maintenance on steam roads is said to be $75

per car per year. The copper sheathing used by the Interborough Company will be lacquered.

Our chief editor has gone to visit the Pacific Coast and the States about and beyond the Rocky Mountains. If he should be slow in answering personal letters the writers had better possess their souls in patience, as there are many opportunities for a letter to miss its goal when it goes chasing addresses that are scattered over four or five thousand miles.

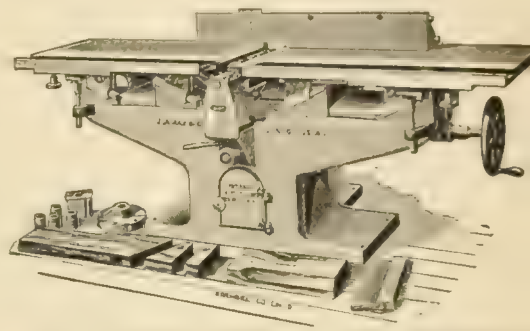
The Cleveland Twist Drill Company have issued what they call "ready reference cards," to hang up in the shop. There are three cards about 9x6 inches, connected at the top by a brass ring, from which the cards hang, but loosely enough to permit any card being readily referred to. The first card contains information about the speed of drills; the second gives dimensions of the U. S. standard system of bolts and nuts and the drill list for gas taps; the third presents the drill list for taps with U. S. standard threads, and for machine screw taps; the fourth shows the drill list for taps with V-shaped threads, and the fifth illustrates the dimensions of taper shanks for Cleveland twist drills, and closes with a table of the parts of an inch in decimals, for use with micrometer calipers. The Cleveland Twist Drill Company will be happy to send a set of cards to those who require them for shop use, and who apply to the company.

A case which Judge Werner, who writes the opinion, regards as unique, was decided by the Court of Appeals of New York in favor of the New York, New Haven and Hartford Railroad against the estate of George Dean, an engineer of the railroad, who was killed in a collision. Suit was brought and a verdict for $5,000 was rendered against the company. The Court of Appeals reverses the decision on the ground that the entire estate of Dean, in New York State, consisted of a watch and chain, brought from Connecticut after Dean's death, for the purpose of giving the New York courts jurisdiction. Judge Werner says an estate in such a case must come into the State "in good faith and in due course of business."

The Railway Appliances Company, Old Colony Building, Chicago, makes the announcement that the business and affairs of the Q. & C. Company have been consolidated with their own and that hereafter the Railway Appliances Company will conduct the business of both concerns. This consolidation greatly enlarges the facilities of the new company, while retaining the individuals heretofore connected with the Q. & C. Company. Both parties to the agreement are to be congratulated.

Large Patent Universal Wood Worker.

We invite the attention of car builders and master mechanics to the machine here shown, as it has been designed to successfully meet most particular requirements. It will do a large variety of work; it saves the use of separate machines, as it does each kind of work advantageously. It is very powerful and adapted for heavy work, and is especially useful in car shops and where large timbers are worked. Special consideration is invited to the following points, which are embodied in its make-up: 1.—It is made to plane 16 inches wide, and will to advantage plane out of wind, surface straight or tapering, rabbet and face inside blinds, rabbet door frames; bevel, joint, chamfer, bore, gain, bead, rip, cross-cut, tenon, rout, groove, work circular moldings, and other like work. 2.—Vibration and wear on all parts are lessened by new and ingenious



NO. 4 PATENT UNIVERSAL WOOD WORKER.

devices, while the different adjustments, change of knives, etc., can be made easily, quickly and accurately, as it has been the aim to make the machine as labor-saving as possible. 3.—An attachment for boring is mounted at back of column, having a table and necessary stops to regulate the cuts. A fence is also provided for angle boring, and a table is placed on top of the boring table for rotary mortising. 4.—The tables are planed true, each has independent vertical and longitudinal adjustments, and are easily raised and lowered. The adjustable fence and bevel rest requires no separate adjusting, as it raises and lowers with the tables. Those interested will be furnished with further details, cuts and terms by applying to the makers, J. A. Fay & Egan Co., of No. 445 West Front street, Cincinnati, Ohio, who will also send free to those interested their new and complete catalogue of wood working machinery.

We can see no more to the bottom of the next few hours than we can see to the bottom of this river.—*Charles Dickens.*

Around the World.

A revival of the dramatic version of Jules Verne's famous story, "Around the World in Eighty Days," was recently presented at one of the Proctor theaters in New York. It is now stated on what is believed to be good authority that a journey around the world in the course of the next year may possibly be accomplished in 40 days. When the rails of the Siberian line are all laid it will be possible on the first through trains to go from Moscow to Irkutsk in six days, and from Irkutsk to Vladivostock or Port Arthur in three days. The time table around the world from Paris will then be: Paris to Vladivostock, 13 days; to Nagasaki, two days; to Yokohama, two days; to San Francisco, 12 days; to New York, four days; to Cherbourg, six days, and to Paris in less than half a day. This may give a new impetus to "globe trotters."

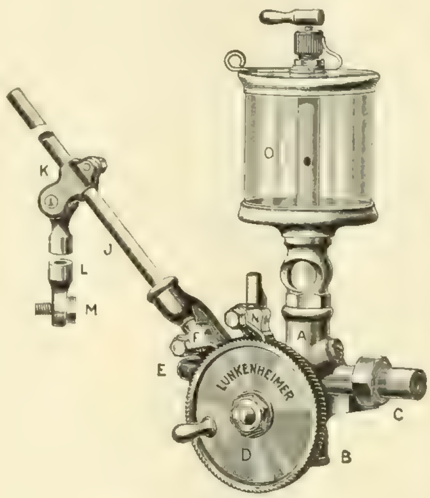
Traveling Engineers' Convention Report.

We have received the volume containing the Proceedings of the Tenth Annual Convention of the Traveling Engineers' Association. It contains the reports and discussions at the last convention and is a valuable and interesting volume. We have published extracts from the report and the discussions but the work calls for an examination as a whole, to show a reader how much more valuable the whole is compared with a part. The volume contains 330 pages of reading matter, nearly every page being redolent with information which every man connected with the mechanical department of railroads ought to study. In paper covers the volume costs 75 cents, and in leather $1.00. The report can be obtained through this office.

The Newton Machine Tool Works (incorporated), of Philadelphia, have just issued their bulletin No. 35. It contains a description of "a new method of keyseating." This work is done by a double-spindle milling machine. The keyway is milled out the required depth and width by a cutter of appropriate size, carried on a horizontal spindle, and the ends are finished by a cutter carried on a vertical spindle, which cutter is the exact width of the keyway. The cutters for this machine go in pairs and are marked accordingly. The tool is neat and substantial, and its operation is not only explained in detail, but is illustrated by three excellent half-tones. A number of other tools made by the same firm are shown in half-tone pictures, but without description. The bulletin will be sent to those who desire it, on application to the Newton Works, Philadelphia.

Lunkenheimer Mechanical Oil Cup.

Reference to our illustration will show a very neat mechanically operated oil cup or lubricator, in which the feed is positive, as it is in fact a small pump. The driving mechanism is of the ratchet type and is operated by the clutches *F* and *N* that work co-operatively by the motion of the rod *J*, which can be attached to the eccentric rod, or other moving parts of the engine, by the couplings *K* and *M*. The motion thus obtained is transmitted to the piston *E* by the crank-pin mechanism *H* and *G*. The ratchet wheel *D* is provided with a handle whereby it can be rotated by hand in case it is desirable to force a quantity of oil at any time, as, for example, when starting the engine. By moving the part *K* up or down the rod, the stroke of the pump can be lengthened or shortened, as desired, thus regulating the amount of oil fed by the pump independent of the feed from the oil cup. The outlet *C* is piped to the steam pipe or chest of the engine, and the spring check valve *X*



MECHANICAL OIL CUP

should be placed as near the end of the pipe as possible, preferably into the steam pipe. The bottom of the pump body *B* is tapped ½-in. pipe thread to receive a stand so that it can be placed wherever desired. The pump is substantially constructed, the workmanship being first-class, and, as the parts are made to jigs and templets, they can all be easily renewed, being perfectly interchangeable. The ratchet wheel *D* and pawls *F* and *N* are made of tool steel, tempered and hardened. All other metal parts about the pump are made of the very best hard bronze composition.

The Lunkenheimer Company, of Cincinnati, Ohio, will be happy to supply catalogue and further information to any one interested enough to apply to them. Their New York office is at 26 Cortlandt street.

What a beautiful thing human nature may be made to be.—*Oliver Twist.*

"When Found Make a Note Of."

That most amusing character in Dickens' "Dombey and Son"—Captain Cuttle, had a habit of saying, "When found, make a note of," about anything which struck him as of peculiar interest. There is much sound advice in the Captain's saying, because the ability to quickly refer to a subject and get the information one wants, accurately and clearly, without trusting to memory, is most important. Just here the question of the ownership of a book one likes comes up. A borrowed book seems to lose some of its value because it cannot be referred to after being read and returned. No one can remember everything in the book he reads, especially if that book is technical in character, and the safest way is to carefully select the book or books which will be of the most use, and then buy and own them out and out. When one owns a book it becomes to him practically a reference library, and he can do what Captain Cuttle recommended with great advantage to himself. Below are a few of the books which we believe will be found useful, and we have made notes of.

A year's subscription to Railway and Locomotive Engineering costs only $2.00, and the paper is a welcome visitor, especially where there are children.

"The World's Railway" is a most interesting history of railways and locomotives. It is beautifully illustrated and the net price used to be $10.00. We now give it and a year's subscription to Railway and Locomotive Engineering for $5.00.

"Locomotive Engine Running and Management," by Sinclair, is an old and universal favorite. A well-known general manager remarked in a meeting of railroad men lately, "I attribute much of my success in life to the inspiration of that book. It was my pocket companion for years." The price is $2.00.

"Practical Shop Talks." Colvin. A very helpful book combining instruction and amusement. It is a particularly useful book to a young mechanic. It has a stimulating effect in inducing young men to study their business. Price, 50 cents.

"Examination Questions for Promotion." Thompson. This book is used by many master mechanics and traveling engineers in the examination of firemen for promotion and of engineers likely to be hired. It contains in small compass a wonderful amount of information about the locomotive. Convenient pocket size. We cordially recommend this book. 75 cents.

"Compound Locomotives." Colvin. A little study of this book will instruct a man so that he will understand the construction and operation of a compound locomotive as well as he understands a simple engine. Tells all about running, about breakdowns and repairs. Convenient pocket size, bound in leather, $1.00.

"Catechism of the Steam Plant." Hemenway. Contains information that will enable one to take out a license to run a stationary engine. Tells about boilers, heating surface, horse power, condensers, feed water heaters, air pumps, engines, strength of boilers, testing boiler performances, etc., etc. This is only a partial list. Question and answer style. 128 pages. Pocket size, 50 cents.

"Care and Management of Locomotive Boilers." Raps. A book that ought to be in the hands of every person who is in any way interested in keeping boilers in safe working order. Written by a foreman boilermaker. Also contains several chapters on oil-burning locomotives. 50 cents.

"Locomotive Link Motion." Halsey. Any person who gives a little study to this book ceases to find link motion a puzzle. Explains about valves and valve motion in plain language easily understood. $1.00.

"Machine Shop Arithmetic." Colvin and Cheney. This is a book that no person engaged in mechanical occupations can afford to do without. Enables any workman to figure out all the shop and machine problems which are so puzzling for want of a little knowledge. 25 cents.

"Firing Locomotives." Sinclair. Treats in an easy way the principles of combustion. While treating on the chemistry of heat and combustion is easily understood by every intelligent fireman. 50 cents.

"Air-Brake Catechism." Conger. Nothing better can be found for people trying to learn all about air brakes. Tells the whole story. Cloth, 75 cents. Leather, $1.00.

"Skeevers' Object Lessons." Hill. A collection of the famous object lesson stories which appeared in this paper several years ago. They are interesting, laughable and best of all are of practical value to-day. $1.00.

"Stories of the Railroad." Hill. Best railroad stories ever written. Those who have not read these stories have missed a great literary treat. $1.50.

"Block and Interlocking Signals." Elliott. Tells what signals are, what they do and how they do it. Comprehensive treatise on the subject. Ought to be studied by all trainmen where block signals are used. $3.00.

Railway and Locomotive Engineering. Bound volumes. $3.00.

A western air-brake repair company has been organized in Pittsburg, Pa. There have been companies organized repeatedly to carry on a business in repairing cars and locomotives, but they seldom have succeeded in making the business remunerative.

Cement Machinery.

Catalogue No. 15 (sixth edition) of the Allis-Chalmers Company, of Chicago, is concerned with cement machinery. In this very handy little publication the methods of making Portland cement are briefly outlined, and the plan and elevation of a modern crushing plant is given.

The Gates rock and ore breaker is illustrated and explained, and the Gates elevator, style "A," is similarly treated. The Gates iron frame revolving screen for "sorting" the sizes of crushed material, is shown in a good half-tone with suitable explanation accompanying it. Fine breakers and crushing rolls are also dealt with. In fact, examples of all kinds of machinery for pulverizing, grinding, breaking and crushing stone or rock or any kind of refractory material, may be found in the Allis-Chalmers' catalogue, and those interested in cheap and expeditious methods of producing railway ballast of any size, will be interested in this publication.

The second part is devoted to the consideration of machinery for producing and pulverizing Portland cement clinker, and among the features presented are the rotary kiln, the raw material storage bin, hot clinker-handling appliances, the ball mill, which is illustrated in half-tone and line cut, thus showing the simplicity and efficiency of the machine, the Gates tube mill, and coal crushing and disintegrating machinery. The Allis-Chalmers Company, of Chicago, will be happy to send a copy to anyone who is sufficiently interested to apply to them for it. Their New York office is in the Broad Exchange Building.

An interesting experiment is about to be made by M. Noblemaire, director of the Paris, Lyons and Mediterranean Railway. He has organized a salon for railway employees which will be held next month under the auspices of the Société Artistique and Literaire. The members of the salon are employees who have a taste for art and literature. Works of art, paintings and sculpture executed by the railway men will be placed on exhibition in the Gare de Lyon.

The Pedrick & Ayer Company have been for a great many years located at Philadelphia, Pa. They have now removed to Plainfield, New Jersey, and are now occupying the new works, which have just been completed. The main building is four hundred feet long and one hundred feet wide. Independent powerhouse, blacksmith shop, pattern shop and pattern storage are also provided. This new shop has been equipped with electric traveling cranes and modern tools so as to enable the company to meet the largely increased demand for their standard goods, consisting of air compressors, air hoists, pneumatic riveters and special railroad tools. The selling office is at 85, 87 and 89 Liberty street, New York City.

No railway company buys a horse after it is seven years old, says the London *Tid-Bits*. The Midland has 1,350 horses, the Great Northern 1,300, the Great Western 1,100, the South-Western 550, the South-Eastern 275 and the London Brighton 225. The London and North-Western has only 650 horses, but the firm that does most of the North-Western business has 4,000 horses. The majority of London railway horses work seventy hours a week. As a rule the London railway horse is bought at £60 and is sold at £10 or £12.

The Joseph Dixon Crucible Company, of Jersey City, have issued what they call a souvenir of an inspection trip made by the American Society of Civil Engineers to the new terminal of the North German Lloyd Steamship Company, in Hoboken, N. J. The souvenir contains a full description of the "new departure in the science of pier construction." The structure is said to be entirely fireproof. Several excellent halftones illustrate the booklet. The entire structural steel and metal work of bulkhead building and piers are protected with Dixon's silica-graphite paint. The Dixon people will be happy to send a copy to any one who cares to apply.

The locomotive engineers of New York State made persistent efforts to have Governor Odell appoint one of their number Railroad Commissioner. Governor Odell is perfectly infatuated in his affection for locomotive engineers, and habitually strains the English language to select expression of admiration for the men who run locomotives. But when it comes to appointing a man to a fat position, that is another matter. He is then ready to strain the law to land a back politician in the place. It is only when they do not want any favor that practical railroad men are popular with the smart Governor of New York State.

The late Spanish-American war seems to have impressed upon the engineers of the Spanish Government the need of adopting the most modern methods in the manufacture of munitions of war. They are installing Westinghouse motors in their gun shops at Trubia, and the Spanish arsenal at Ferrol is also shortly to be equipped with a number of motors and other electrical machinery.

Nature often enshrines gallant and noble hearts in weak bosoms.—*Old Curiosity Shop.*

The Pratt & Whitney Company, of Hartford, Conn., have issued a neat little catalogue of new model turret lathes, in which they illustrate and describe these very useful machines. Concerning the work that may be done they say that these tools are not only adapted to repitition work in the production of duplicate pieces in large lots, but their use is advantageous for the manufacture of duplicate lots of not more than six pieces. The catalogue contains 37 pages and is illustrated with half-tones and line cuts. The company will be pleased to forward a copy to any one interested enough to apply. The main office is in New York, at 136-138 Liberty street.

The Kennicott Water Softener Company, of Chicago, state that their patents have all been taken out in the name of Cass L. Kennicott, and that they have not granted any licenses, so that the use of their inventions, save in their own apparatus, is unwarranted and they intend to protect their rights in the courts in all cases of infringement. A suit is now pending in the United States Circuit Court for the second Judicial Circuit.

A London dispatch states that the Scotch locomotive builders have practically completed a combination of the trade in Scotland. Hitherto there has frequently been mutual rivalry among the builders, which hindered successful competition with foreign makers. They believe that by combining they will be enabled to multiply the recent successes achieved by them in Canada, Japan and India against American and German competitors. The capital of the combination will be between £2,000,000 and £3,000,000. The combination at present, it is said, embrace three Glasgow firms, Neilson, Reid & Co., the Hyde Park Locomotive Works and Sharp, Stewart & Co., employing 7,000 hands.

Lanahan, the division roadmaster on the High Line, has sound views on the reward due to responsibility. The old man sent for him and breaking the news easily told him he had a job of general roadmaster for him. "What's the price?" said Lanahan—he never wastes the Queen's English. "A hundred and twenty-five," said the old man, and while he was looking for a perfecto for Lanahan the division roadmaster had wafted himself out. The old man's clerk was telling me about it the other day. The old man took the joke gracefully too; he respects the man who would rather be a division roadmaster at full price than figure as a general roadmaster on two-thirds pay. Lanahan wants results. That's cash, not glory. No "forty-nine" cent sign for him.

Speed of Woodworking Tools.

People accustomed to iron or other metal-working tools have, as a rule, very erroneous ideas about the cutting speed of woodworking tools. A properly driven circular saw has a periphery speed of 7,000 feet per minute—nearly a mile and a half per minute, or nearly 80 miles an hour. A band saw is driven at about half the speed of a circular saw. Planing machine cutters have a speed of 6,000 feet per minute at the edge; and the cutters of molding machines slice out material at about 4,000 feet per minute. Wood-carving drills are run 5,000 revolutions per minute, while augurs 1½-in. diameter are run 900 revolutions per minute. Those half that diameter are run 1,200 revolutions per minute. Mortising machine cutters make about 300 strokes a minute.

Dyspeptic Man in a Hold-Up.

"About six years ago I was riding through Southeastern Colorado on a westbound train. There were about twenty-five or thirty men in the smoker, all pretty comfortable-looking chaps. A dyspeptic-looking little man, about 40 years old, with a Bostonese patois, sat in a seat ahead of me and an hour or so after I boarded the train he engaged me in conversation.

"Belong out this way?" he inquired of me in his Down East drawl.

" 'Yep,' said I.

" 'Reason I ask you that,' said he, 'is that I've heard there have been a lot of robberies on the railroads out this way lately. That right?'

" 'Pretty close,' said I.

" 'Ever find yourself involved in one of those affairs?' he asked me.

" 'Couple times,' I told him.

" 'Did you let 'em go through you?' he asked me, with a searching look.

" 'Don't you think otherwise for a holy minute,' said I. 'I am my sole remaining support, and, in general, I find life a pretty good game. It's the best I know anything about for sure, anyway.'

" 'Well,' said the dyspeptic-looking little man in his piping voice, 'I'd just like to see the loafers get any of my money, that's all. I'd just like to catch them at it!'

" 'Why, what would you do?' I asked him, grinning right in his teeth; I couldn't have helped it to save me.

" 'Never you mind, sir, what I'd do!' said the little man, choppily. 'I'd take good care that they didn't get any of my goods, however! I'd fix 'em! Yes, siree, the train robber doesn't walk in shoe leather that's ever going to relieve me of a copper cent, and don't you fail to remember that, sir!'

"The little man, who, as I afterward ascertained was on his way to California for his health, looked so puff-toady and fierce while he was getting off these

brave remarks that I couldn't help but laugh in his face. That nettled him a trifle, but I smoothed it over and made a remark or so to him about the general nature and character of stick-ups.

" 'My friend,' said I in conclusion, 'the only advice I can give you is this: If any of these chaps ever comes along your way and asks you to call heaven to witness with your two hands pointing to the zenith, just you do the same, that's all, and do it in a hurry; do it a-running; be nice and pleasant about it, and don't get gay. Don't endeavor to frivol any with a man who's got the edge on you with a forty-five lead-spitter.'

" 'Well, just let one of 'em try it with me, that's all!' exclaimed the little man, and then we changed the subject.

"Well, about 9 o'clock that night we pulled up at a little station called Tyrone to give the engine a drink. We only halted there about four minutes, but it was long enough. The train hadn't got more than five miles out of Tyrone before we heard a lot of shots up forward—the smoker was the second car from the engine—and the train came to a halt.

"The wheels had scarcely ceased to revolve when the front door of the smoker was thrown open with a bang, and the command rang through the car like the crack of a whip:

" 'Everybody put 'em up—quick!'

"A tall, raw-boned man, with a straggling red mustache, stood in the door calmly waving his gun from side to side with the characteristic movement of an expert gun-fanner. He looked business all over.

"I decided instantly—I'd put my hands up before I'd done any deciding, however—that he wasn't any amateur and that he was going to get all that was coming to him. I couldn't help but notice that the dyspeptic-looking little man in front of me threw up his hands with the rest, although he did a little bit of fumbling with his right hand before it went up in the air.

" 'Seein' that my podner's busy keepin' tab out in front,' said the raw-boned bandit—he didn't wear any mask, and there was a certain devilish twinkle in his eye as he spoke—'I'll just ask you gentlemen to spring what you've got on you with one hand at a time, as I pass along, and I'll do the rest.'

"He wore a hickory bag suspended by a string aroung his neck, in front of him—a bag similar to that worn by carpenters and lathers for holding nails, and he just reached out his left hand and dropped wallets, watches and loose rolls into the bag as he passed along. None of the passengers had any chance to hold out anything on him, for he was one of the eagle-eyed kind, and he seemed to see all hands in the car at once.

"He walked sideways down the aisle, so as to be sure that he wouldn't be plunked from behind after passing along. He was an artist in his business, all right, was that raw-boned person, and he didn't miss a trick. Every man up forward unquestioningly forked over his belongings to be dropped into that roomy bag.

"The dyspeptic-looking little man amused me, with his arms sticking up there as rigid as poles, so that I almost forgot to worry about what I was going to lose when it came my turn. He had become as white as a sheet, and he looked even more ghastly as the robber approached him.

"Finally, it came his turn. The robber looked him over with a grin.

" 'Sorry, my sawed-off chum,' the robber started to say, when puff, the right hand of the dyspeptic-looking little man opened with cat-like rapidity and the robber got a fistful of red pepper square in the eyes. He let out a howl and the little man dropped to the floor like a flash. So did I, for that matter.

"The robber, yelling like a madman, lowered his gun hand and groped around with it, and half a second later he was butted in the stomach with all the force the little man from New England had in his head. That doubled the robber up, and a minute later we were all on top of him at once.

" 'You will try to appropriate what doesn't belong to you, hey,' doggone you!' shrilled the dyspeptic-looking little man, standing over the blinded bandit, who was almost insane from pain.

"We bound him securely, did what we could to alleviate his misery, and put a guard over him. The robber who was sticking up the engineer, hearing the agonized shouts of his pardner, concluded that there was nothing doing, and, firing a few bluff shots, scampered off the tender into the darkness.

"We took the raw-boned bandit to Trinidad, where he was tried and, as I afterward learned, got twenty years. And that's one time I got fooled up a heap in a stickup."—*N. Y. Sun.*

Baldwin's people have received an order from the Southern Pacific for forty locomotives with the Vanderbilt furnace. These engines will burn oil. The Southern Pacific Company already have some locomotives with the Vanderbilt furnace which have given highly satisfactory results as oil burners. The furnaces are said to outlast two fire-box engines burning oil. A curious thing about experience of railroads with oil-burning furnaces is that the Santa Fé people received more service from fireboxes than from Vanderbilt furnaces, while the Southern Pacific was the opposite way, although the service in both cases was about the same.

The Science of Chemistry.

It is wonderful the familiarity with practical chemistry acquired by many of our readers. They begin the study of elementary chemistry in connection with studies of combustion, and the subject proves so attractive that they keep up the study as an amusement.

What may be called the primary elements of chemistry were known to the ancient Egyptians. That race did not find out very much about the composition of the various substances found on the earth, but they had made some progress concerning matters whereon the foundation of chemistry rests. Knowledge of the nature of substances was developed by the study of medicine, and the manipulating of domestic arts developed knowledge of combinations that formed part of the facts from which the science of chemistry was gradually built up.

The Egyptians preserved dead bodies by compounds whose composition is not clearly known to modern science; they fixed colors in silk by means of mordants; prepared many medicines and pigments; they also made soap, beer, vinegar and many other commercial compounds. Of course the Chinese were familiar with chemistry before western nations, their principal discoveries having been in dyes and in the preparation of metallic alloys. But they also found out how to make gun-powder, porcelain and other things that were not found out by the savants of Egypt, of Greece, or of Rome. The Romans added very little to the world's chemical knowledge.

During the social and political eruptions that accomplished the overthrow of the Roman empire suppression of acquired knowledge prevailed and many facts concerning matter discovered by ancient nations were no doubt lost. After several centuries of darkness the Arabs became the chemists of the world. The useful discoveries they made were connected with alchemy researches.

Alchemy is believed to have had some connection with the mysticism of Egypt, and to have originated in that land, although the Arab philosophers became its most devoted adherents. Alchemists believed that by mystic rites certain base metals could be converted into gold, and that a certain elixir or mysterious compound could be concocted that would indefinitely prolong human life. A work on alchemy compiled by Gebir has the right to be considered the first work on chemistry, for although there is much nonsense in it there are interesting facts mentioned and experiments described.

With the popular cultivation of ignorance and the wooing of superstition and bigotry that followed the downfall of Rome and the destruction of the Saracen power, chemistry made no progress for many centuries. A mixture of alchemy and chemistry lingered among students in religious houses and in institutions of learning, but what we might call legitimate knowledge was badly mixed with beliefs in magic, necromancy and other delusions. Believers in the gold cure for the alcohol habit might find that the principle of this faith originated with the alchemists. Roger Bacon, born 1214, was one of the greatest lights of alchemy and a writer whose works are more chemical than alchemical. He believed that "aqua-regia," which is gold dissolved in nitro-hydrochloric acid, to be the elixir of life, and urged its use upon Pope Nicholas IV.

From the time of Roger Bacon there were numerous students of the properties of matter who gave their discoveries to the world and knowledge was accumulating. By the middle of the century so many discoveries had been made and recorded that Lavoisier, a French investigator, arranged about 1785 a system of chemical nomenclature which still remains the skeleton of the science. Lavoisier devoted himself zealously to investigating phenomena connected with combustion and by use of the balance proved that the act of combustion was a combination of carbon with oxygen. This introduced quantitative chemistry, which proved that no loss occurred when chemical changes were effected. This knowledge brought with it the law of the indestructibility of matter.

Since Lavoisier organized the science of chemistry it has exercised more influence on human affairs than all the other sciences combined, the great discoveries in other sciences having nearly always had the path illuminated by chemistry. That is true of metallurgy, of steam engineering, of its sister science, electricity, and of many others. The person who does not possess a talking acquaintance with chemistry is to-day behind the times.

The portion of the floor where tires are shrunk on, in the Reading shops of the P. & R. is very handily fitted up with trestles, gas pipes and the various requisites for that sort of work. The floor is made of cast iron plates, dished down at the edges all round, and perforated all over like the stay-bolt holes in a crown sheet, though with wider spacing. By this arrangement when a heated tire has been put upon the wheel center, and the hose turned on, all the small wooden blocking lying about is not floated away by the water or the shop floor made into a sort of marsh as it often is in other shops. The only floating is done by the steam which floats off in the form of a harmless cloud as the tire cools while the shop floor is kept dry and the water drops through the perforations in the iron floor, and finds its way into the shop drain.

Long and Short Valve Travel.

I notice on page 77 of February Railway and Locomotive Engineering that P. R. J. asks if a short valve travel has any advantage over a long travel with the same cut-off. This question brings to my mind a 17x24-inch passenger engine that we had on a three-car run, time two hours for 61 miles, and 13 stops. This engine had 4 1-4 inches valve travel, and in some way she got a pair of new valves with 7-8-inch outside lap; her steam ports were 1 1-4 inches wide, and when working in full gear her valves traveled just far enough to give full port opening. This engine would start her train as quick as any of the engines of this class, but could not be worked closer than the third notch, and on a windy day the fourth notch was the running notch and time was frequently lost, as the engine would not run very fast. My theory was this: The outside lap was so great compared with the valve travel that in the first notch there was no port opening; in the second notch she would get 1-8 of an inch port opening, and in the third notch she would get 1-4 of an inch of port opening and a cut-off of 6 inches; at the fourth notch she would cut off at 8 inches, and while she would work good and strong in these last two notches, at the same time the lever would be so far forward that the valves would not have the required amount of lead to give the engine the requisite speed. By planing these valves to 5-8 outside lap she would make the time easily in the first notch, as she then got the same port opening in the first notch as she originally had in the third notch, and her lead in the first notch was increased nearly 1-8 more, making the engine easily ten miles an hour speedier than she originally was.

C. D. Greig.

Cherokee, Ia.

The Norton Grinding Company, of Worcester, Mass., say that with one of their gap grinding machines arranged for grinding piston rods with the pistons in place, an operator in a prominent railroad shop in this country recently reground a pair of piston rods in eight minutes each. This represents the grinding time only. The time required for placing the rod in the machine and taking it out being the same as though the rods were turned instead of ground, and this time would depend entirely on the facilities for handling the work. If the latest up-to-date compressed air hoist were used, the complete time for placing the rod in the machine, grinding it and laying it down, would be not over fifteen minutes each. The time of re-turning as practiced in most shops is from one and a half to two hours each. Valve stems were also ground in from fifteen to twenty minutes each. Crank pins in from five to fifteen minutes each, depending on the size and shape.

This machine, they say, is a great advance over any other appliance for doing this class of work, not alone because of the saving in time which can be effected, but in the accuracy of the work produced.

A correspondent in London informs us that we made a mistake in the January number by saying that the standard track gauge in Japan is 3 feet, when it is 6 inches wider.

There is a strong prejudice among foreign locomotive men against steel for fire-boxes and tubes, but for the latter steel is slowly forcing its way into favor. There is some objection to securing a steel tube in a copper tube-plate, but when common sense tries for a little longer to leap over the wall of prejudice the steel tube-plate will be found quite satisfactory.

The Derry-Collard Co., of New York, are issuing a series of pamphlets illustrating certain machine shop operation. The first one is on turning tapers. The illustrations are admirably done and the pamphlet is very finely gotten up. It costs only 25 cents.

It is reported that American electrical apparatus is making progress in European markets. The Société Anonyme Westinghouse has found it necessary, on account of the great number of orders received, to make extensive additions to their plant, which has been in operation for only five years. This plant is situated at Havre, France, and supplies the territory included in Holland, Belgium, Italy, Switzerland, Spain, France and their colonies and protectorates.

We are informed that the Texas & Pacific Railway have placed an order for fifteen freight engines with the American Locomotive Company. They will be built at the Cooke Works of that concern, at Paterson, N. J. Delivery is booked for May 1 of this year.

Every car shop in the country and locomotive works has more orders than the year will see filled. Lines are struggling with each other to be first served. So persistent are they in pressing their orders that manufacturers are oftentimes paid a large bonus for special attention in delivery. Every car foundry in the East wants additional employees, but labor is difficult to obtain.

The Jenison Iron and Engineering Company has been organized to manufacture certain specialties, among them an electric headlight. Their works will be at Jenison, near Grand Rapids, Mich.

One result of the Westfield collision on the Central Railroad of New Jersey is that the company has decided to use the standard train rules of the American Railway Association, to regulate the movement of trains. Every railroad in the country ought to do the same thing.

It is fewer than thirty days since the Lackawanna contracted with the Pullman Company for entirely new equipment in the way of sleeping cars, but already these have been supplied for the night lines between New York and Buffalo, from the Buffalo plant, and very soon the through lines will have received their full quota.

Lord Claud Hamilton, president of the Great Eastern Railway, of England, made a public statement lately about American locomotives. He said his company had tried them for a year and a half and found them a distinct failure. He expressed himself as being against American railway methods generally.

A press dispatch from London says that Messrs. Kerr, Stuart & Co., of Stoke-on-Trent, have secured a contract for heavy locomotives, of the American type, for the Interoceanic Railway of Mexico. It is stated that many builders in the United States competed for the contract, but the English firm guaranteed a lower price and speedier delivery.

A compound locomotive which has been a success on a road where the work of hauling trains is nearly uniform may prove a failure where heavy pulls and long stretches of drifting are common. Several railroad companies have found this to be the case.

The heat utilized in doing useful work by the medium of a steam engine is rarely more than 6 per cent. of the potential energy of the fuel used. To catch part of the 94 per cent. of waste has been the favorite labor of thousands of inventors, and it led to the invention of the compound engine. The success achieved by that invention has not been worth much boasting.

The first railroad ever built in this country for watermelon traffic is being constructed in Southeast Missouri by the Burlington. It will be fifty miles long, extending from the interior to the Mississippi River, and goes through a country which raises enough melons to keep it very busy during the season.

Arrangements have been made to give the Pennsylvania Railroad the entire output of the Pressed Steel Car Company.

The New Canadian Locomotive Works.

Work on the new Montreal Locomotive and Machine Company's works at Longue Pointe will begin in a very short time.

The estimated output of locomotives for the first year will be one hundred. Later it is intended to extend the scope of the work to take in bridge work and ship building. From the start, however, tenders will be put in for foreign work as well as that originating in Canada. Mr. G. P. Brophy, of Ottawa, is the managing director of the company, while Mr. R. T. Shea, formerly of the Schenectady Locomotive Works, Schenectady, N. Y., has been chosen as superintendent of the locomotive works. The necessary equipment is now being purchased in New York, at a cost of from three to four hundred thousand dollars. The motive power will be entirely electrical. The active operations of the works are expected to begin in August.

Mr. Dudley Walker, of the Chicago & Alton, Chicago, has got out a neat little railroad picture, about 7x9 inches, called "Her First Run." It represents a charming girl sharing the engineer's seat in the cab, she holding the notched up reverse lever, while he has his hand on the throttle. It may be that a hymeneal "coupling" will be made later on, but in the picture the right of way occupies the attention of both. Mr. Walker will be happy to dispose of these pictures at 25 cents each.

The Consolidated Railway Electric Lighting and Equipment Company held a meeting of directors early in February, at which Mr. Isaac L. Rice was re-elected president, and the duties heretofore performed by Mr. J. N. Abbott as vice-president and general manager were added to those performed by the president, Mr. Abbott having terminated his connection with the company. Mr. J. L. Watson was re-elected secretary and treasurer. All communications to the company should be addressed as above, the office being at 100 Broadway, New York. This company is widely known as the owners of the Axle Light System. This system not only includes the lighting of trains, but the ventilation of cars by the use of electric fans. The company's system is in use on the best trains of many leading railway lines and on all private Pullman cars and most of the private cars of railway officials.

The report of the Massachusetts Railroad Commissioners for 1902, just issued, shows among many other things, that the heaviest locomotive used in that State in 1892 weighed about 65 tons. Now the consolidated railroads send engines there weighing 78 tons, and the Boston & Albany has some that weigh 95 tons.

Accommodation at Mackinac.

Mr. John W. Taylor, secretary of the M. M. and M. C. B. Association, has issued a circular to members giving a report of the joint committee on time and place, in which it is stated that a careful inspection of the Grand Hotel and grounds at Mackinac has been made. The report says that the location is all that could be desired, and that the Grand Hotel can conveniently accommodate twelve hundred people in the style to which the associations have been accustomed. Cottages and smaller hotels are within a few minutes' walk of the Grand Hotel, and the overflow, if any, can be accommodated comfortably. The circular also states that accommodation for exhibits has never been surpassed.

British Expresses.

The *Locomotive Magazine*, of Charing Cross Road, London, has issued a very handsome volume, containing a series of railway pictures, some few of which are in colors: the rest are half-tones. The first series is on British expresses, in which some of the best-known trains, such as the Flying Dutchman on the Great Western, the American Car train on the South Eastern, and many others are given. The second series contain views of the world's famous trains; among others appears the Black Diamond on the Lehigh Valley, the "Sud" express on the Paris-Orleans line, the Scotch express on the London and North Western, and the Imperial Limited on the Canadian Pacific. The third series comprise British express locomotives during the Victorian era. Twelve types are given, ranging from 1837 to 1899. Locomotives of 1900 forms the next series, in which the summer trains and engines of various nations are given. The tandem comdem compound, four-cylinder, ten-wheel engine, 697, on the A. T. & S. F., closes the series. "Locomotives at Work" follows next. "Cars of 1900" cover the British and Continental field, and the book concludes with a series comprising the locomotives of all nations, among which may be mentioned the "Victoria" on the Great Southern and Western Ry. of Ireland, the French "wind splitter" on the P. L. M., and the heavy passenger ten-wheel engines of the Chicago & Eastern Illinois.

Copies of this very interesting reference book may be had at the office of Railway and Locomotive Engineering, 174 Broadway, New York.

The Baldwin Locomotive Works have agreed to present a locomotive to Sibley College, the mechanical engineering department of Cornell University. The engine will be of the de Glehn type of compound. That class of engine is used largely in France and bears a high reputation for efficiency and durability.

CONTENTS.

PRESSURE IN P(…)5 80 85 90 95 100

When charged Brake valve handle in Full Release Position

Ol… E… Dis… Go… to b… pre… set…

Imp… F… Dis… Gov… to… vol… an…

Old style Equalizing Discharge Valve Handle in Running Position Excess pressure spring set for 20 Lbs

sta…

ch…

Emergency Application (Travel of piston 8 inches)

Pl…

Qu… Tr…

…IR BRAKE INSPECTOR,
K… & A. R.R., SPRINGFIELD, MASS.

Color Air Brake Chart, Issued by Railway and Locomotive Engineering.

DESIGNED BY E. G. DESOE, GENL. AIR BRAKE INSPECTOR,
B. & A. R.R., SPRINGFIELD, MASS.

Railway and Locomotive Engineering

Copyright by Angus Sinclair Co.—1903

A Practical Journal of Railway Motive Power and Rolling Stock

Vol. XVI. 174 Broadway, New York, April, 1903 No. 4

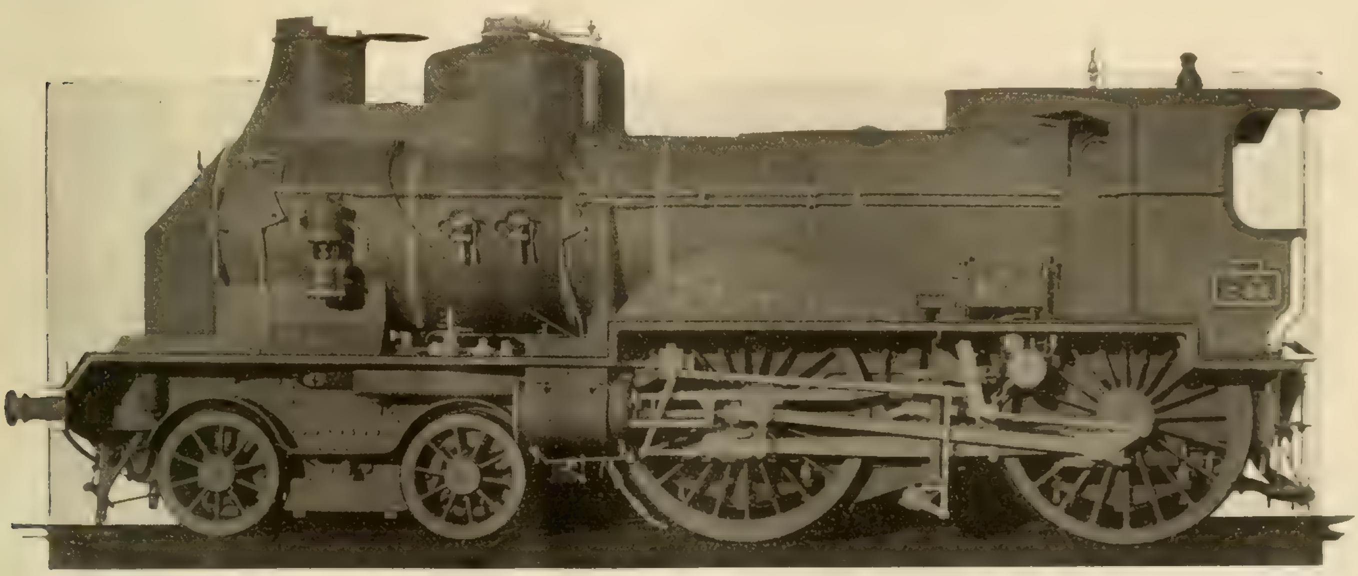
Paris, Lyons and Mediterranean Locomotives.

The two French locomotives here illustrated are the latest engines designed for the Paris, Lyons & Mediterranean, by the chief mechanical engineer of the system, M. C. W. Baudry, whose portrait is also published. Both of these engines are compounds, with four cylinders, two inside and two outside the frames. Particulars of the designs can be obtained from the line cuts.

The 8-wheel type of engine has proportions adapted to high speed, while the ten-wheeler is designed to combine moderate speed with much power. These locomotives are regarded on the continent of Europe as the highest development of the locomotive designers' art. The parts of the two engines are practically interchangeable except the changes made necessary through difference in size.

Common characteristics of all the engines are steel boilers with Serve tubes, Belpaire fire boxes, the inside part being of copper, and extended smoke boxes, with pointed fronts to reduce atmospheric resistance.

These engines have revolution counters and speed-recording mechanism which is worked by connection with the valve gear. A tape fed at uniform speed under a marking hammer striking once every four revolutions indicates speed of train, shows duration of stops, slow downs, etc.



FAST PASSENGER ENGINE FOR PARIS, LYONS AND MEDITERRANEAN SYSTEM.

The Young Engineer.

BY SHANDY MAGUIRE.

May his tribe increase, because it means that our country shall progress along present lines from ocean to ocean, and from lakes to gulf, in the same thrifty manner in which it is making time at present; for it means the setting up of men to meet the necessity, instead of relegating beginners back to the furnace door, and giving an Irish hoist to the older ones.

Not a million miles away from where this sketch is scrawled is a road doing a trunk line business, subject to its ebb and flow for about ten months in the year, and not entirely stagnant during the other two. It is necessary that if to-morrow business would expand 50 per cent. from what it is to-day, that men would be available. The methods of the officials of this system are to set up and set back; a very laudable one, yet with its soul-harrowing tortures to one official at least. Without any abnormal flow of verbiage devoted to beating about the bush, it is as well to state here and now that the one poor unfortunate, with a title to the tail end of his name, and who is known on the locos by his initials only, is the round-house foreman. Poor fellow! A bosom of sympathy is his due, and unsparingly dealt out to him by the pen-pusher of this sketch. If the Good Book is to be relied upon there is a future reward beyond the heartaches and the crosses of this life for the unfaltering slave who forms the first link in the connecting chain, binding the low-downers in officialdom with the august personage reclining upon the topmost pedestal of the throne of authority.

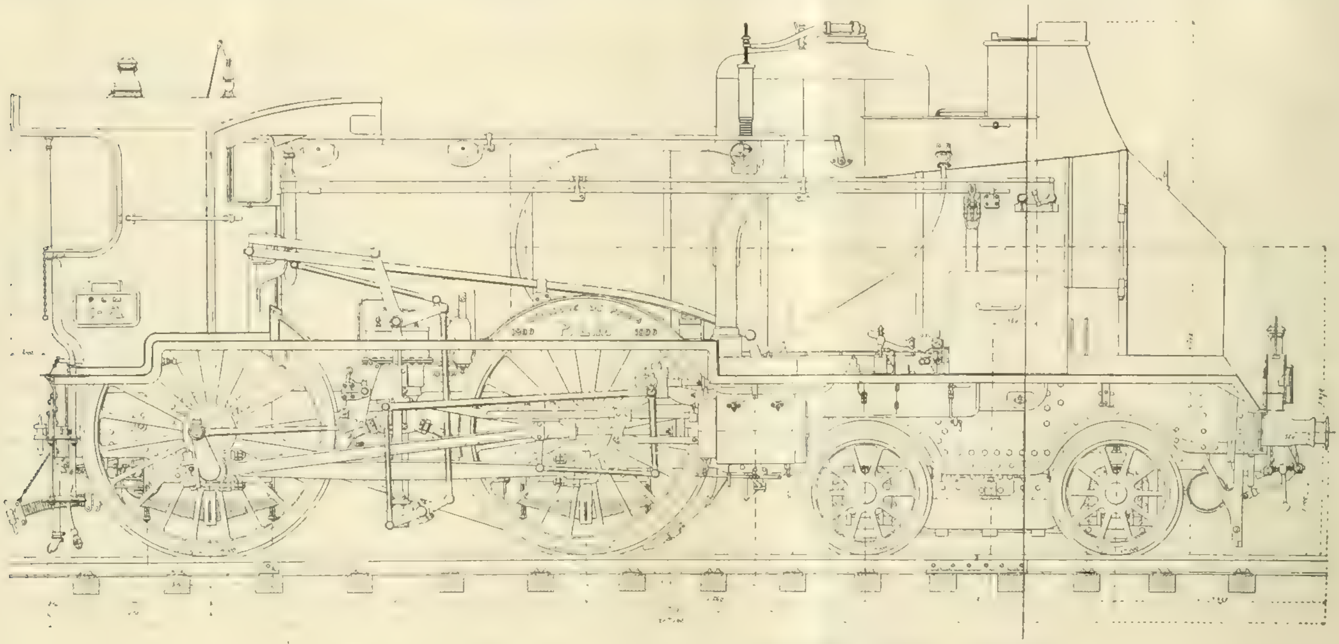
The following order came duly autenticated to Terrence Bennett, round-house foreman, on a recent date:

"To-morrow we will begin again to handle the West End Traffic. Arrange accordingly.

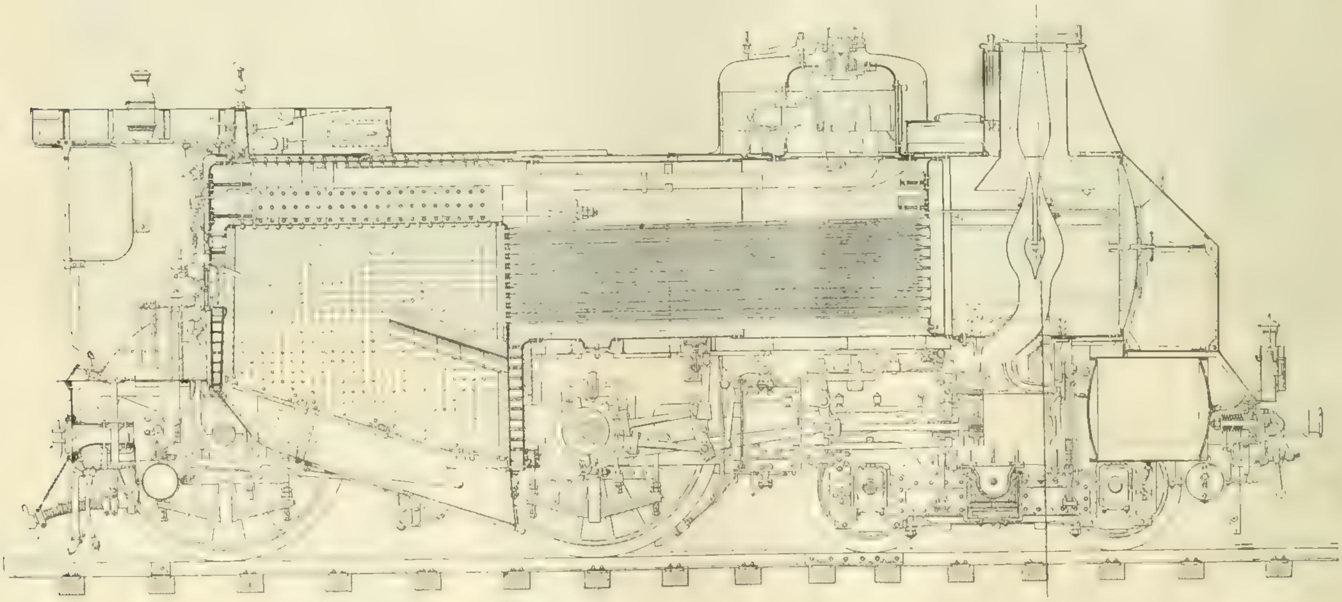
(Signed) R. L. JORDAN, Div. M. M."

That meant six additional crews to be made up, six wipers to be promoted to firemen, and six firemen to be again made lords paramount of the cabs of six engines to be fired up and put into service. The first day passed without any noticeable change from normal conditions. It was after round trips were made that the tribulations of Terry began. He went to examine the round-house report book, at the usual time, in

order to be the judge of the most important work to do in the line of running repairs on the engines, with his very limited help, so as to keep them moving until their wash-out day, which occurred once a month at the company's shops, located in the middle of the division. Out of the eleven engines reported defective on the book the three run by the young runners had more work reported to be done on them than the other eight, and they but a few days out of the shop, from a general overhauling, before having been laid up.



OUTLINE ELEVATION OF P. L. M. FAST PASSENGER 8-WHEEL ENGINE.



SECTION THROUGH CENTER LINE OF P. L. M. FAST PASSENGER ENGINE.

A few hours later the other three youngsters arrived, and they also took the post of honor on full pages. The next day being Saturday, the book got a greater burden to carry than on the previous day. Nearly all the old stuff was repeated, and all the additional defects, real or imaginary, that the youngsters could trace. Bennett said nothing pro or con after he examined the various tales of woe, which was interpreted by the round-house man to mean that some other engines than those on the West End traffic would not be given the go by.

The next day, which is known throughout Christendom as the Lord's Day, Bennett, who, "to keep peace in the shanty," as he expressed it later on, accompanied his wife to church. As he was walking with the air of a liberated slave at her side, in all the splendor of his Sunday-go-to-meetin's, and taking pride at the envious glances he saw sidled at her stunner of a hat, top-hampered with a huge portion of the very latest furbelows, he was overtaken by one of the young fellows he set up running two days previous, who stepped in between himself and her, doing in an instant what it takes the courts of the land quite a spell to accomplish, outside of Dakota or Chicago, and began the following conversation:

"Say, Mr. Bennett, me right hand packin' is blowin' so that it is all I am able to do to get over the road; me valves are squealin' also, the left hand injector kicks once in a while, and the main rod brasses on the right side wants reducin'; there is a leak in me mud ring that wants corkin' "——

"Mr. Daley," said Terry, "put it on the report book and we will see to it tomorrow," trying to break off the conversation and shake the fellow, so he could drop back a few paces and again walk with his wife, who fell behind after she got cut out.

"I did put it on Friday mornin', yes-

terday, and agin this mornin', but old Dunphy pays no attention to it, so I want to report it to you."

"I appreciate your thoughtfulness, particularly at this time, and I shall attend to it." He wanted to cut the interview off as abruptly as he could, without losing patience, in consideration of where he was going. At the crossing of an intersecting street he saw Jim Chamberlin coming towards him. He wanted to avoid him, but gave it up as a bad job, for once Jim got his eye on him he kept it there till they met. Jim was chairman of the local grievance committee, bloated accordingly, as his method of address indicated.

"Bennett, why can't I get me packin' set out on the left side?"

"Have you reported it?"

"Yes, and I might as well be reportin' it to the man in the moon, for the work won't be done."

"To-morrow I'll see to it and find out the reason."

"See that you do, and have the drawbar shortened between the tank and engine, pack the throttle and run me valves over; I have a headache from the way I go hoppin' along."

Bennett was an easy going sort of a church militant man, traveling in a go-as-you-please way on the heavenly road, utterly regardless of the rules of orthodoxy. He picked up Martha again and gave her a look she knew right well how to read, as much as to say: "Do you suppose going with you to church is to redound to my honor and glory up above?" She soothed him by saying: "Never mind them. They mean all right; as they grow older they will gain more knowledge from experience."

They were now almost at the sacred edifice, and Terry supposed his troubles were all behind him. It was the popular hour of church going, and a small jam occurred on the porch, as too many met there for comfort. While he was trying to protect the streamers floating from Martha's hat from flying under the feet of the middle aislers, who were out in force, for a spell upon their knees, he found himself caught by the coat-tail to attract his attention, and make him turn round, which he did.

M. C. W. BAUDRY.

"Say, Terry, why can't I get the work done on me engine I report?"

The poor fellow; he jack-screwed down again the gorge arising in his throat, in consideration of where he stood, and in accordance with the teachings of the meek and lowly Nazarine, to whose honor and glory the temple was erected he was endeavoring to enter, he said: "I'll see that it is done hereafter, Mr. Doran."

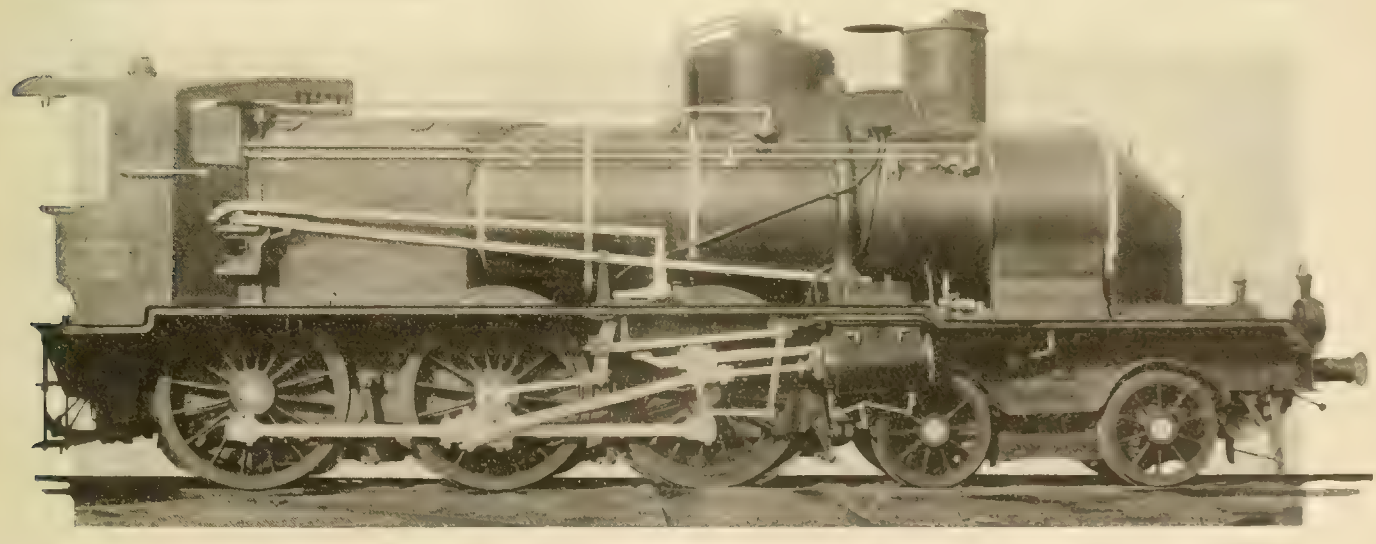
"Well, take care that you don't forget it; be sure that the pound is taken out of the main box, left side; it makes her ride harder than hell."

"May the devil pound you back to the handles of a wheelbarrow, where you never should have graduated from, you shallow-pated mule," exclaimed Bennett, in the hearing of all, who supposed the Lord had made him insane for having the audacity to enter His house on the same footing with them, the pillars upon which it rested. Poor Martha felt her position keenly, and entirely forgot her new headgear in the tittering going on. One old, bugle-eyed spinster looked at her with a glance intended to annihilate her, then with a lip-twist of hate at the hat, said audibly: "Oh, my! feathers are droopin' to-day."

Martha immediately replied: "Miss O'Grady, my feathers are paid for. My husband owes no one a dime, although he is not a church-goer, yet he pays my bills here and elsewhere, and helps to maintain a pew to seat such tramps as you are, who come here to defile the house of prayer with the vile ravings of an unchristian heart and vicious tongue, as you are doing to-day. I approve of his acts. He should be permitted to pass into the pew with the same indifference as your old nobody of a father entered, but being a man of superior standing in the community of worshipers here, he had to endure the annoyance his distinction was awarded."

"'Tis thrue for ye, Mrs. Bennett; put that in your heart and nourish it, Miss O'Grady, and I'll take me oath it will sink deeper than the word of God does into it to-day," said big Tom Kelly, Bennett's hostler, who stood near.

Terry went direct to the round-house from the church and asked Dunphy what he was doing. "Readin' the report book," said Tom. "There is more work put in it by the extras than we could do in a week of Sundays. They don't know



TEN-WHEEL PASSENGER LOCOMOTIVE—PARIS, LYONS AND MEDITERRANEAN

what they are blatherin' about. I'll prove it to you."

"How?"

"Chump Daley thinks the spring cylinder packin' is yet in 43. Ask him in the mornin' how it acted to-night, or I'll ask him in your hearin.'"

"Do so, Tom, you have more patience with such men than I have."

Next morning Daley was in on time, and Tom said in Terry's hearing:

"Chump, old boy, I set yer packin' out on both sides yesterday; how did it act last night?" All Dunphy did was to put a wrench mark on the cylinder casing nut, each side, so as to have it pass muster should Chump know enough to notice if it had been off.

"I never saw such improvement, Tom; I was good for four more cars."

"Then the blow is all taken out?"

"Not a whimper left. Here, smoke on the head of it," and he handed him one, three for five.

"How is that for high, Mr. Bennett?" said Tom, when Chump got out of hearing.

"That's good," said he, "and a first rate way to find out that what some men don't know would fill a bigger book than what they know. Work that racket, Tom, to your heart's content, and perhaps holding their ignorance for laughable discussion among the other men may deter them from filling page after page of a report book with stuff that is unnecessary. With some of the artists manipulating throttle bars the notion prevails in their heads that it gives them standing to put down all sorts of jobs, whether they can be done or not, like Jim Chamberlin did when he put down to shorten his draw-bar between tank and engine, and a company's blacksmith not within fifty miles of here, and no chance to send it away to be done, and it no worse than it has been in the last year. Tom, the company equips school cars to educate men how to handle the air-brake. It would be a good thing to add to the curriculum of the car some much-needed instruction for new beginners. What do you say if I get some one to give a lecture to them some evening here in the round-house?"

"It would be first rate," said Tom, "and I beg to suggest, as the chief clerk says, that you be the lecturer yourself, for you know a thing or two about how the old thing works."

"Agreed," said Terry.

In the last year $328,403 was paid as pensions to retired employees of the Pennsylvania Railroad. The scheme has been in operation three years, and in that time $864,000 has been paid out to 1,851 employees.

There's no situation in life so bad that it cannot be retrieved.—*Pickwick Papers.*

To Prevent Railroad Strikes.

A recent despatch from The Hague says: Premier Kuyper introduced in the Second Chamber of the Staats General three bills in connection with the recent railway strike. He explained that the government considered it necessary to oppose any unreasonable attack on society, which would sacrifice the well-being of the people to the desire of a certain class for influence, and to political tyranny, The government, therefore, proposed to form a railway brigade, to insure a regular service of trains in case of need. The just complaints of railroad employees would be adjusted by a Royal Commission, which would be entrusted later with the settlement of the situation from a legal standpoint, as well as regarding the conditions of service of the employees. It also would have to decide what constituted criminal acts. The government did not desire to be reactionary. It only aimed at affecting social reforms. One of the bills provides for a modification of the penal code, with the object of affording a surer guarantee for the personal freedom of labor and preventing state officials or persons engaged in occupations affecting public interests from absenting themselves from their duties.

First Aid to the Injured.

It may cause a smile to say so, but it is nevertheless quite true that one of the important results which training in first aid to the injured on a railway usually brings about is that it guarantees protection to an injured man from the deadly attacks of his most devoted and faithful friends. One cannot study the statements constantly made by railway surgeons without seeing clearly that it is of much importance to instruct men thoroughly in what *not to do* in case of accident as it is to prepare them for any definite line of action in an emergency. It is therefore without surprise that we see that Dr. J. D. Milligan, chief surgeon of the P. & L. E. R. R., said in a paper recently read before the Railway Club of Pittsburgh, "that the prayer of the injured is not always 'Oh, Lord, save me from mine enemies,' but it is 'Oh, Lord, save me from my friends.'" He had often found that some uninstructed but overzealous person may easily undo what nature was trying to do, and what nature would have succeeded in accomplishing if she had not been interfered with.

Sir Frederick Treves, who successfully operated upon King Edward, is reported to have said of his experience in the South African campaign that he had learned to let a perfectly clean Mauser bullet flesh wound heal itself. The railway surgeon to-day has often to deal with a wound, not clean, as the accident left it, but packed with tobacco"chews," covered with old germ-bearing cobwebs and soaked with black oil or kerosene.

We remember once seeing a fireman who had cut the artery in his wrist on a broken pane of glass in the roundhouse one night in the mountains, taken 50 miles on a light engine to the nearest doctor with the wound so badly bound up that it bled constantly and the injured man had been given several "horns" of whiskey "to keep up his strength," with the result that the heart action had been stimulated and had so pumped out more blood through the wound than otherwise would have been lost. In this case the surgeon literally saved this man from his friends.

First aid instruction does not turn men into amateur surgeons, it very often prevents them from simply making bad worse or restrains them from introducing needless complications with which the railway surgeon has to contend or the railway claims agent subsequently settle for.

In this connection a few facts presented by Dr. Milligan to the Pittsburgh Club are interesting. Among other things he said: "Consider that on June 30, 1900, there were employed 972,808 men by the railroads in the United States, that there were 39,643 injured and 2,550 killed, for the year ending June 30, 1900, and that in that statement we mean all who die within 24 hours—are declared killed—and all who are disabled to the extent of three days, are classed as injured, it shows at a glance that there is plenty of room to apply first aid, and also the grim necessity of prompt and efficient application of the same."

Railroad Mileage in the U. S.

The total number of miles of track in the United States up to June 30, 1901, as given by the Interstate Commerce Commission, is 265,352 miles. This includes single track, double track, three track, four track and all yard track and sidings. Just here we may say that the mean distance of the moon from the earth is about 240,000 miles, so it is easily seen that we have enough railroad track in this country, if laid as a single line from the top of some lofty mountain, through the air to reach "her celestial highness," and when we had done that we would have something over 25 000 miles of track to spare. The moon's diameter is about 2,160 miles, so that we could lay down a line which would go round her equator more than three and one-half times. If the moon ever thinks of flying off into space, Uncle Sam's transportation companies know their duty. A train traveling continuously at the rate of sixty miles an hour would, if it started on January 1, cover the entire distance and probably strike the lunar bumping post about 4th July.

Canadian Pacific Coal Car.

"The object we had in view in designing this car was to construct a vehicle for the carriage of coal which would retain its status as a coal car to the end, and not degenerate into a sort of coal sack by sagging in the middle and bulging at the sides." So, in effect, spoke Mr. D. McNicoll, second vice-president and general manager of the Canadian Pacific in giving RAILWAY AND LOCOMOTIVE ENGINEERING the photograph from which our half-tone illustration is made. The elimination of the chance of sagging and bulging which are the two evils which coal cars are heir to, was not rendered any easier by the fact that the car was required to have side doors, but the form of construction finally adopted, we are told, has given excellent results in service.

The outside sills are timber, 14 in. deep by 5 in. wide. The intermediate sills are really composed of two members each 9 x 5 in., spaced 1 in. apart, with packing piece between, and through these sills the long U-bolts, which pass around the stake pockets are bolted. In addition to this, from each stake, a rod runs right across the car through the floor; a bolt at the end of the stake passing through the side sill, secures the stakes very firmly to the outside sills.

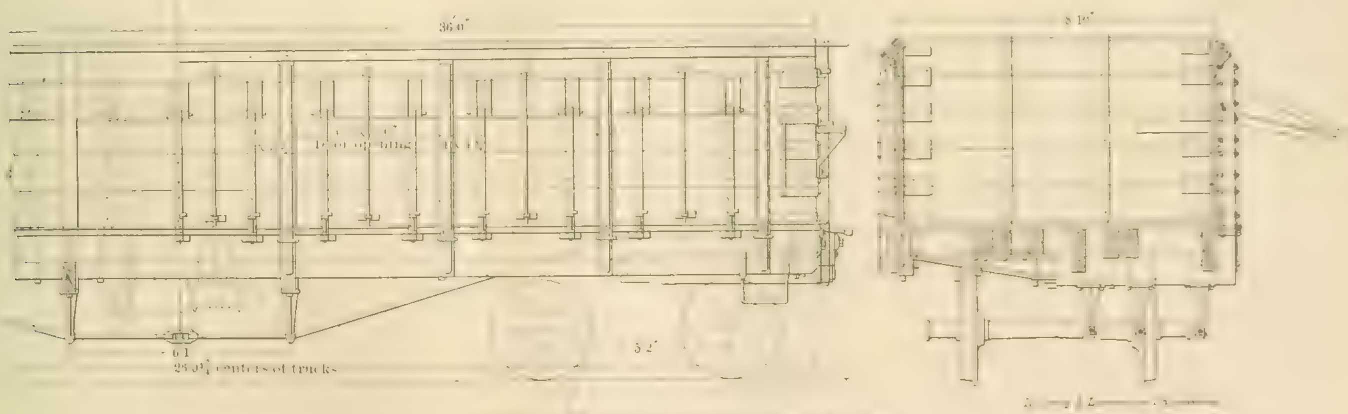
The double intermediate sills are placed within 5 in. of the center sills and 22 in. from the outside sills, so that the central portion of the car, which cannot receive any stiffening from the side walls, is carried on six timbers and is thus made quite rigid. The whole car floor is also supported by six through truss rods of extra depth below the needle beams, so that the chance of sagging is reduced to what may be called a negligible quantity.

The bulging propensity which coal cars evince, is also guarded against. Although the stakes are 4 ft. apart and contain a side door between each, the full width of the panel, the door itself is 3 ft. high, while the total height of the side is 5 ft. 1-2 in. Therefore the coal car side is solid all along the upper two feet of its height, and is reinforced by a longitudinal timber of triangular section, resting on top of the stakes and capped by an angle iron, the full length of the car. This coping of wood and iron, together with the fact that the stakes are all outside the side planks, makes bulging a most difficult, if not an impossible feat for the load of coal inside, to perform.

The ends of the car have no stakes, but the "coal box" is anchored down by flat iron straps which grip the top plank and are bolted through the end sills. Six flat corner plates unite end and side planks.

CANADIAN PACIFIC SIDE DOOR COAL CAR.

The side doors open flush with the floor, and when in position are held closed by two bolts in each, which drop into staples on the side sills and cannot shake out or let the doors open by accident. These doors are provided with permanent rods or latches which hold them open when required. Neither hinges, latches nor any door attachments extend beyond the line of the stakes, so that there is nothing along the sides of the car to catch on anything or be torn off.



CANADIAN PACIFIC RAILWAY COAL CAR.

The car may be considered as a partial automatic side dumper, and if all the doors were open perhaps about 25 per cent. of the load would be discharged, the rest would have to be shoveled out by hand. The car is 40 tons capacity, having about 1,488 cu. ft. volume, and weighs light, about 37,000 pounds. The design shows much careful working out of details and the clever adaptation of means to an end, upon which the C. P. R. officials may reasonably congratulate themselves.

Still in the Ring and Younger Than Ever.

The Syracuse *Post-Standard* of recent date has followed the fortunes of the famous engine "999" on the N. Y. C. & H. R. The engine has been thoroughly overhauled and is in service again. In a recent issue that paper says: "No. 999 is now rattling off miles in sixty seconds nearly every day, much to the glee of her engineers, who declare that she is 'as good as they make 'em,' old as she is. Last night No. 999 left the New York Central station at Syracuse, N. Y., eastbound at 9:30 o'clock attached to train No. 32, the Mail and Express. The western division had delivered the mail three-quarters of an hour late in Syracuse. It is required that the train be drawn to Utica in an hour and fifteen minutes from here, which is just one minute faster than the celebrated Lake Shore Limited travels, and the limited does not carry nearly as many cars as the twelve heavy ones taken out by No. 999 last night. It was necessary to make up time, too, for Uncle Sam

watches the schedule of the mail trains very closely. So what more natural than that No. 999 should have this job? It isn't fashionable business nor notorious business that the old wonder is doing to-day. But no piece of motive power on the New York Central is 'earning its coal' more worthily."

A beautiful line engraving of this typical "American" locomotive, printed on heavy plate paper about 30x12 ins., and suitable for framing, with every part numbered and a corresponding tabulated index in the margin, will be mailed free to any address in the United States, Canada or Mexico on receipt of 25 cents in coin or in stamps. Address RAILWAY AND LOCOMOTIVE ENGINEERING, 174 Broadway, New York. See advertising page 3 in this issue.

"The Public Demand It."

The phrase "the public demand it" is a very familiar one to readers of the daily press, and the thing which the public is always represented as demanding most strenuously is speed in railway or steamship travel. If any railroad puts on a fast train, or if a few knots per hour are added to the speed of an ocean greyhound we are at once told that it is the result of a popular demand in that direction. In fact, the expression is used so often that many railway men, steamship men and even the dear, good, long-suffering public itself has at last come to think that there must be something in it. If the public go on demanding and demanding and demanding there is no knowing where it will all end—provided the phrase is true, which it is not always, by any means.

We have known the inhabitants of a large city to do some really good, vigorous demanding, and to keep it up, and yet get little or nothing in return. Right here it is interesting to note that, as a rule, in the cases where real demanding on the part of the public has not accomplished anything, one factor in the problem has almost invariably been omitted. An incident taken from life may help to make plain what this insignificant factor really is:—

The president, the general manager and some other high officials of the Rock Ballast & No Dust Railway met in secret conclave the other day. After prolonged consultation it was decided to put on a splendid, through, night train on their road. It was to be hauled by fast, powerful engines and it was to be composed of superbly appointed sleepers. The train was to leave and arrive, from and at terminals at most convenient hours for the traveling public, and altogether no luxury was to be considered too good for the patrons of the road. The whole scheme was worked out quietly within the four walls of a railroad office, and the public did not know the first thing about it. "Do you think we will secure *all* the business?" asked the president. "I know we shall," replied the general manager. The train was duly put on, and extensively advertised as the "Night blooming Cereus," and it was a great success—after the public found out what had been done.

Now it so happened that the Me Too & We Also Railway discovered that they had been badly "scooped," as the saying is, when this train began going at full speed, so they straightway went into the market and procured a train which Solomon need not have been ashamed to show to the Queen of Sheba. They called it by an even more enticing name than that of its rival and they let it be known that their train was hauled by the latest "Mongoose" type of engine which was simply a compound of speed and power, and certain death to snakes. This railway therefore eventually divided up the business evenly with the R. B. & N. D road, as it was in the beginning. When everything was as it had been before the trains were run, somebody worth knowing complimented the general managers of both lines, at a public banquet, and spoke in glowing terms of the gold-plated, diamond-studded service which they had inaugurated between important cities, and the speaker was told by the managers in reply that though it was very expensive yet the public had demanded it. In all this the person, or the insignificant factor, or whatever you like to call it, named Competition, who had brought it all about, and had been the means of giving the public a really good thing, wasn't referred to at all in the speeches and wasn't mentioned as being "among those present." In fact, he wasn't even an "also ran," but he got there just the same, while the public went home from the banquet thinking that they had demanded the trains and had got them.

Kept His Nerve.

The engineer had been many years in the service of the road, and it is a well-known fact in railroad circles that in time the majority of engineers lose their nerve. They become too cautious, and as a result they get their trains in late.

This engineer—and this is a true story—had lost his nerve. He had a passenger engine, and twice he had been told that if he could not bring his train in on time he would have to begin hauling freight. That is a pretty hard threat to throw at an engineer, and he meekly promised to do better.

On the occasion of the third warning he asserted that he would bring the train in on time "even if there was a brick house on the track and a barn in addition."

He came into the office after his "run" a day or so later, glancing about the room, looked up at the ceiling and then asked:

"Seen any of it?"

"Of what?" asked the official.

"Coal!"

"Coal?" repeated the official. "Why should we expect to see any coal here?"

"Oh, I guess it hasn't come down yet," answered the engineer carelessly.

"What do you mean?" demanded the official.

"Some one left a loaded coal car on the main track," explained the engineer. "Switch turned too soon or a coupling broke, I guess. Anyway, it was there."

"And you——"

"Oh, I got in on time. I'm not like a man who has lost his nerve—not by a good deal."

"But the car! How did you get around——"

"I didn't get around. I pulled her wide open and came through. There's about half a ton of that coal on the top of the rear coach, and I was expecting to find the rest of it here. The last I saw of it was high and scattering."

"Great Scott!"

"And say!"

"Well!"

"The smokestack of the engine is gone, there's no pilot left, and the windows of the cab are busted. But, of course, I was acting under orders, and I got in on time. And say, again!"

"Well!"

"Just put it down on your books somewhere that an engineer who hasn't lost his nerve, but is tired of keeping it, resigned from the service of the road today, and is going to look for a job on a farm."—*Buffalo Enquirer.*

Ingenious Belt-Shifter Carrier.

A simple and most ingenious belt-shifter carrier designed by the general foreman of the P. & R. shops at Reading, Pa., may be seen by the observant visitor, or will be gladly shown to others on request. The carrier can be put in any position or at any angle, and will work as well standing on its head as it will in the conventional position. It consists of two separate arms, each terminating in a flat disc perhaps 4 in. in diameter. On one side of each disc is cast a number of radiating V-shaped ribs. When these two discs are properly bolted together the V-shaped ribs engage and preserve the angle at which the two arms may have been placed. To alter the angle, the slacking of a nut will allow for new adjustment. One arm is secured to the post, the other holds the belt-shifter and the carrier falls in pleasantly with any angle which circumstances may demand.

Let us try to be sensible; let us try to be good-natured; let us try to be fair.—*Little Dorrit.*

Growth of the Locomotive.

By Angus Sinclair.

(*Continued from page 114.*)

AGITATION IN FAVOR OF RAILROAD BUILDING.

While the Baltimore & Ohio Railroad was the first in the United States to have a section opened for regular traffic, and the first railroad on which a native-built locomotive did useful work, the promoters of other railroad enterprises were not waiting to see if the Baltimore undertaking would be successful. Before 1830 ended the Legislature of nearly every State in the Union had granted charters for railroads, and many of them were in course of construction before the year was far advanced.

EFFECT OF CANALS ON TRADE.

The tendency of canals was to divert commerce toward certain centers and consequently deprive other places of business which had previously been theirs. There had been considerable mileage of canals constructed before 1830, and much more was projected and under way. The towns that could not receive benefit from canals naturally looked to railroads to help them and bring to their warehouses commerce that the waterways were trying to divert. This was what stirred up the business energy of Baltimore in favor of a railroad to establish transportation between the Susquehanna and the Ohio Rivers. The road in fact from its inception was intended as a rival to the Chesapeake & Ohio Canal.

NEW YORK CITY AGAINST RAILROADS.

The apathy which the people of New York, the most important city in the country, displayed toward railroad building, was due to the fact that they supposed the Erie Canal, constructed by other people's money, would bring them all the business they could handle. The rich city of New York has always taken a discreditable position concerning railroad property. Its politicians have always succeeded in taxing the State people heavily to maintain the Erie Canal so that it might depress railroad rates; yet the railroads have at all times moved passengers and freights cheaper than the subsidized canal.

CHARLESTON OBTAINS CHARTER FOR A RAILROAD.

About the time that the good people of Baltimore were preparing to invest their capital in the construction of a railway, the citizens of Charleston, South Carolina, were laboring to establish railroad communication with Hamburg on the western border of the State, 136 miles away. A charter for the road was obtained in 1827 and renewed for some reason in January, 1828.

The projectors of the road appeared to be very enterprising and sagacious business men, for one of their first moves was to induce the Legislature to pass a bill exempting the property of the company from taxation.

The enterprise of building a railroad to the western part of the State was very alluring for Charleston. The town is built in a region of swamps that brought little local trade, but by reaching out to the uplands, the city would draw not only a large shipping trade from good cotton-raising districts, but would also bring purchasers for the goods handled by its enterprising merchants. The ground was of such a character that a great part of the road from Charleston to Hamburg had to be built on trestle work. That did not discourage the promoters of the scheme, however, for pine was plentiful and cheap and labor cost less than in any other part of the country.

MANAGEMENT BY LOCAL TALENT.

The company was managed at first by local talent, and one of the first acts of the directors was to offer a prize of $500 for the best locomotive driven by horse power. American ingenuity was quite equal to meet this requirement, and the prize was awarded to C. E. Detmold, who invented a horse-driven motor worked on an endless chain platform. This motor carried twelve passengers and attained a speed of twelve miles per hour. Its performance was regarded as satisfactory.

A sailing car was also tried on this road, but its career was even shorter than that of one tried by the Baltimore & Ohio Railroad about the same time. The crew, who engaged to manage it on the trial trip, were more accustomed to manage horses than sails. When going before a fresh breeze at about twelve miles an hour, and loaded with fifteen passengers, the mast went by the board carrying the sail and as many of the passengers as it could scoop off. That broke the taste of Charleston citizens for sailing on land.

HORATIO ALLEN APPOINTED CHIEF ENGINEER.

The impression having reached the directors that something better than local talent was necessary for the officers performing scientific duties, the position of chief engineer was offered to Horatio Allen, who probably knew more about railroads than any man in America at that time. Mr. Allen accepted the place, and within thirty days made an exhaustive report recommending the kind of road to be constructed and the kind of power to be employed in operating it.

Mr. Allen had spent several months in England the previous year studying the construction of railways and of the power employed in operating them. He had been commissioned by the Delaware & Hudson Canal Company to purchase some locomotive engines for the piece of railroad they intended to build, so that he probably enjoyed the best of opportunities to study the design and proportion of the engines under construction in the few shops in the British Isles then devoting themselves to that kind of work.

TRACK THAT TREVITHICK'S ENGINE RAN ON.

ALLEN RECOMMENDS LOCOMOTIVE POWER.

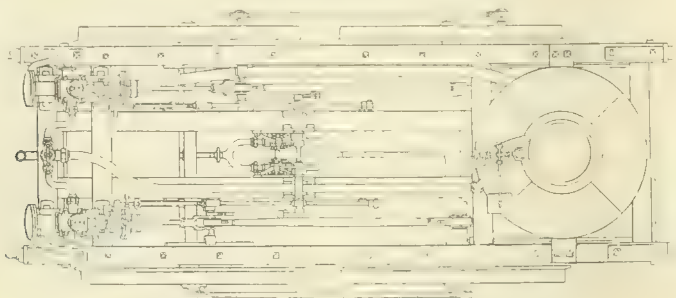
In reporting to the directors of the Charleston, South Carolina, Canal and Railroad Company, as the corporation was officially called, Mr. Allen urged that a structure sufficiently strong to carry locomotives should be built, and that locomotives be employed to operate it. The directors met on January 14, 1830, and the Chief Engineer's report was fully endorsed. A resolution was adopted which said that the locomotive alone should be used upon the road, and in selecting that power for its application to railroads, the maturity of which will be reached within the time of constructing the road, would render the application of animal power a great abuse of the gifts of genius and science. This was the most progressive action hitherto taken by a board of railroad directors, and the Charleston Railroad was the first in the world to decide positively that the road should be operated by locomotive engines.

When the Erie Railway was completed to Dunkirk a great celebration was held and Mr. Allen was one of the principal

speakers. Concerning his connection with the Charleston Railroad he said:

ALLEN ON THE SOUTH CAROLINA RAILROAD POWER.

"At the same period, that was, prior to the great locomotive trial in England, when the Baltimore & Ohio Railroad Company were so strongly impressed in favor of horse power, it became necessary for me as engineer of the South Carolina Railroad Company to decide for what power that road should be built. The road was one hundred and thirty-six miles long. From the character of the country the plan of the road would be naturally influenced by the kind of power adopted. Stationary power was out of the question, but the opinion was held, by many of great intelligence, that horse-power should at least be commenced with. In the report I read on this important question, I submitted such comparative estimate of the results of the horse-power and locomotive-power as the information then to be had appeared to me to sustain. That estimate was in favor of locomotive-power, but I rested the decision of the question on the position that, what the performance of a horse was and would be, every one knew; but the man was not living who would undertake to say what the locomotive was yet to do, and I may add that, after more than thirty years have elapsed, during every one of which the soundness of this position has gained new grounds to sustain it, he would be a bold man who would say that we had attained the limit in the performance, and especially in economy of performance of this great mechanical blessing to mankind. In the recommendation of this report in favor of locomotive-power, the Board of the South Carolina Railroad Company unanimously concurred,



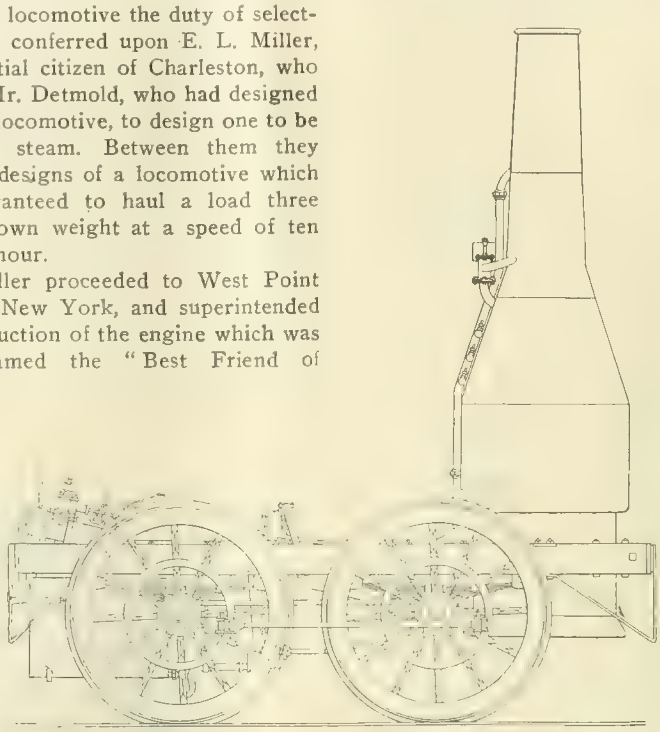
PLAN OF THE "BEST FRIEND." FIG. 17.

and as this decision was the first on any railway built for general freight and passenger business in this country or in England, it has been referred to as one of the interesting facts in the early history of railroads."

MERCHANT DESIGNED FIRST AMERICAN LOCOMOTIVE.

The spectacle which was witnessed, of a merchant unaccustomed to mechanical pursuits designing the first locomotive for the Baltimore & Ohio Railroad, was nearly paralleled on the Charleston Railroad. Although the advice of Chief Engineer Allen had been followed when he recommended the use of steam locomotives for power, he did not at first control the designing or selection of the engines. When the company decided to purchase a locomotive the duty of selecting it was conferred upon E. L. Miller, an influential citizen of Charleston, who engaged Mr. Detmold, who had designed the horse-locomotive, to design one to be driven by steam. Between them they produced designs of a locomotive which they guaranteed to haul a load three times its own weight at a speed of ten miles an hour.

Mr. Miller proceeded to West Point Foundry, New York, and superintended the construction of the engine which was wisely named the "Best Friend of Charleston." The reading world is quite familiar with the appearance of that engine, here illustrated after the original drawings which are in the possession of the American Society of Civil Engineers.



THE "BEST FRIEND OF CHARLESTON." FIG. 16.

DETAILS OF THE "BEST FRIEND."

A curious thing about the design under the circumstances of its origin is, that it shows decided originality and displays a high order of engineering ability.

Particulars of the engine were given in a letter written in 1859 to William H. Brown, author of the "History of the First Locomotives in America," by David Matthew, one of the pioneer locomotive engineers, who was foreman of machinists in West Point Foundry, Beach street, New York city, when the "Best Friend" was built. The salient parts of Mr. Matthew's letter reads:

"The 'Best Friend' was a four-wheel engine, all four wheels drivers. Two inclined cylinders, at an angle, working down on a double crank, inside of the frame, with the wheels outside of the frame, each wheel connecting together outside, with outside rods. The wheels were iron hub, wooden spokes and felloes, with iron tire, and iron web and pins in the wheels to connect the outside rods to.

"The boiler was a vertical one, in form of an old-fashioned porter bottle, the furnace at the bottom surrounded with water and all filled inside full of what we called teats, running out from the sides and top with alternate stays to support the crown of the furnace; the smoke and gas passing out through the sides at several points, into an outside jacket, which had the chimney on it.

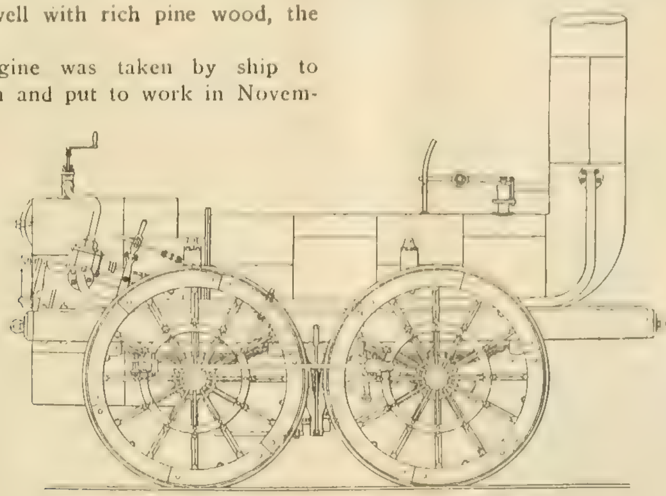
"The boiler sat on a frame resting upon the four wheels with the connecting rods by it to come into the crank-shaft. The cylinders were about 6-inches bore and 16-inches stroke. Wheels about 4½ feet in diameter. The whole machine weighed about 4½ tons."

As the tons were long, or 2,240 pounds, the total weight was about 10,000 pounds. Figured by our present rules, the traction force with 50 pounds boiler pressure, was about 400 pounds. Running at a speed of 20 miles an hour and working steam at three-quarters' stroke, the engine would develop about 12 horse-power.

The boiler, which was decidedly original in design, appears to have been the

prototype of the Hazleton and other boilers which have teats as evaporating surface. It was perfectly efficient and steamed well with rich pine wood, the fuel used.

The engine was taken by ship to Charleston and put to work in November, 1830. The wheels proved too weak for the lateral strains put upon them in rounding curves and had to be rebuilt with wrought iron spokes.



THE "WEST POINT." FIG. 18.

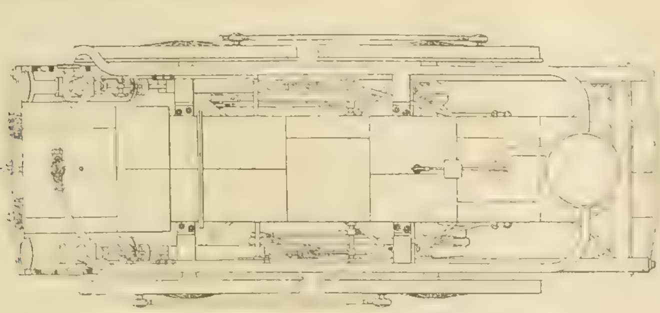
When the "Best Friend" arrived at Charleston about seven miles of the road had been finished, and the engine was put to work hauling material for construction.

"BEST FRIEND" HIGHLY EFFICIENT.

The engine proved highly efficient and doubled the stipulated power and speed. The engineer who first ran her wrote that the engine hauled forty or fifty passengers on four or five cars at from 16 to 21 miles an hour, and ran at a rate of thirty-five miles an hour without a load.

BOILER EXPLODES.

About seven months after the engine was put to work, the negro fireman, who was left in charge while the engineer superintended the loading of cars, annoyed by the noise of the safety valve, fastened the valve down and sat upon it with the result that the boiler ex-



PLAN OF THE "WEST POINT." FIG. 19.

ploded. The excessive pressure fractured the crown sheet and the reaction threw the boiler in the air.

THE FIRST MASTER MACHINIST.

The engine was afterwards rebuilt in the shop of Thomas Dotterer, a Charleston mechanic. The work was done under direction of Julius D. Petsch, who applied straight axles with outside cylinders and cast-iron wheels. The rebuilt engine was christened the "Native" when she first emerged from the repair shop; but that name was afterwards changed with decided propriety to the "Phœnix." Mr. Petsch, who had displayed so much skill in re-designing and rebuilding the engine, was appointed master machinist of the road and he was the first man in the world to hold that title.

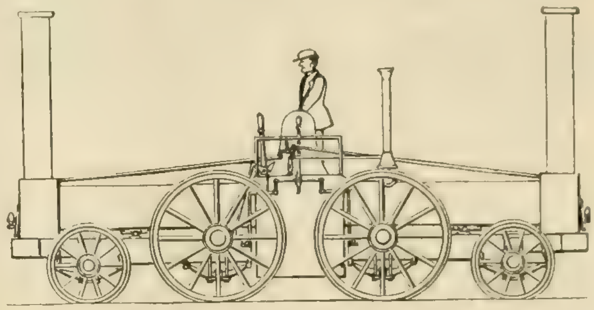
THE WEST POINT.

Before the "Best Friend's" boiler exploded another locomotive was ordered from the West Point Foundry. Mr. Miller again being chief designer. This time he specified an engine with a horizontal boiler, but otherwise the frames, wheels and cylinder connections were very similar to those of the "Best Friend." The boiler had a square firebox with dome on top. Six or eight tubes about three inches diameter and six feet long conveyed the products of combustion from the fire-box to the smoke box, which was merely the base of the smoke stack. The engine was called the "West Point."

That engine went into service early in 1831, and did the work required quite satisfactorily. In a public test made shortly after being received, she hauled four passenger cars, carrying one hundred and seventeen passengers, nine persons more on the engine, and a barrier car carrying six bales of cotton, two and three-quarter miles in eleven minutes. The "barrier car," which was always loaded with cotton, was a regular feature of all passenger trains at that time and was advertised as being used to protect passengers *when the locomotive boiler exploded.* An explosion seemed to be regarded as a regular occurrence.

HORATIO ALLEN'S DOUBLE-ENDED FREAK.

After the "West Point" was received, Horatio Allen, the chief engineer, undertook to design a locomotive, and one was built at the West Point Foundry in 1831. It was a double-ended freak, and vindicated the good sense of the directors in employing ordinary business men as locomotive designers in preference to a civil engineer. Mr. Allen was a good civil engineer, but with things mechanical he was a failure. The engine he purchased in England was antiquated at the time it was bought, but a clear-headed business man would have stiffened the trestles to carry it safely.



THE "SOUTH CAROLINA." FIG. 20.

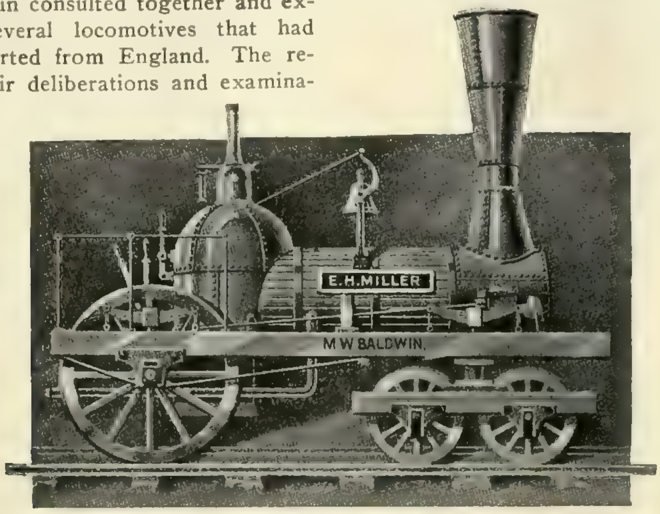
His double-ended locomotive was called the "South Carolina." The boilers were ridiculous vagaries. They had a single fire-box in the middle with two barrels side by side extending to smoke boxes at each end. The engine had eight wheels arranged in two trucks, one pair of driving wheels located close to the fire-box and one pair of small carrying wheels close to the smoke box forming a truck. Each truck had one cylinder which was in the middle of the engine and attached to the smoke box. The driving axle had a crank in the middle, to which the connecting rod was attached by a ball-joint.

The engine was built and put to work, but, like most other freak locomotives,

most of its time was spent in the repair shop.

BALDWIN'S SECOND ENGINE.

When the railroad company was ready to order their fourth engine, which was in 1833, the services of Mr. Miller were again sought, and he went to Philadelphia and consulted with Mr. M. W. Baldwin, who had built one locomotive, and was inclined to engage in the work as a regular business. Messrs. Miller and Baldwin consulted together and examined several locomotives that had been imported from England. The result of their deliberations and examination of engines was, that Mr. Baldwin agreed to build a locomotive for the South Carolina Railroad.



BALDWIN'S SECOND ENGINE. FIG. 21.

The engine built was called the "E. L. Miller." It had outside frames and a single pair of drivers behind the boiler and a four-wheel truck under the smoke box. The cylinders were set on top of the frames at the sides of the smoke box, and transmitted the power to half-cranks inside the driving wheels. The boiler was of the Bury or hemispherical type, with a dome on top.

A HORSE LOCOMOTIVE.

This engine was delivered in March, 1834, and became one of the most famous locomotives of its day. Its form was standard with the Baldwin until the necessity for heavier power gradually led to radical changes of design.

This story as told will give an idea of how far the development of the locomotive was worked out and influenced by the pioneers connected with the Baltimore & Ohio and South Carolina Railroads. When the "E. L. Miller" was put in service, the South Carolina Railroad was the longest railroad in the world.

(*To be continued.*)

A "Compound" Street Car.

The term compound locomotive is well understood, but the expression used as the heading of this article requires a little explanation. The Compania de Tranvias de Merida, of Merida Yucatan, Mexico, is experimenting with street cars propelled with compound steam engines, and the "works" are all well out of the way on the front platform or under the car. The boiler is of the automobile type, and is placed on the front platform at one side so that the door is not blocked. The fuel is gasoline. Water is supplied from two tanks at the opposite end of the car and gasoline is carried in a similar tank placed between those containing water. The throttle, lever, reverse lever, injector, feed pump, brake, etc., are all within easy reach of the motorman. The engine drives a shaft which is connected to one of the axles with a sprocket and chain, and both the wheel axles carry sprocket wheels and are connected by an endless chain.

The engine, which is a very compact compound, was made by the Reeves Engine Company, of Trenton, N. J., and is light and rigid in design, and intended to stand a lot of hard usage, and to keep going day in and day out. The cylinders are 3 1-2 and 6 1-2 inches by 5 inch stroke. When running 600 revolutions per minute, with 200 pounds pressure, with reverse lever well notched up, it is said to be able to develop about 25 horse power, and greater duty can easily be obtained as circumstances arise. Both cylinders are made in a single casting lagged with asbestos. There is a central valve between the cylinders and steam passes from high to low pressure cylinder as directly as possible.

One feature of these engines is that at the moment when live steam is entering the high pressure cylinder it passes into the port leading to the low pressure cylinder, where it is blocked by the head of the valve, but is permitted to fill an ample groove all round the valve. When the valve reaches the cut-off point live steam is imprisoned in this groove, and when the opening to the low pressure cylinder is made by the movement of the valve this stored-up live steam in the groove helps to augment pressure and temperature of steam entering the low pressure cylinder. It is claimed that by this means condensation in this cylinder is very considerably reduced. The central valve is actuated by a fixed eccentric and its cut-off is independent of the position of the link. The admission valve simply permits steam to reach the high pressure cylinder as the admission and exhaust ports are separate. The groove just referred to has another function, it is made to contain the compression or cushion steam for the high pressure piston so that the clearance in this cylinder is reduced to a minimum.

Altogether the experiment is a novel and interesting one, and the performance of the compound steam street car will be watched with considerable interest.

Mechanical Brains.

Most machines improve upon hand labor only by insuring greater uniformity of product and cheapening the latter. Once in a while, though, a mechanism is invented which seems to think also. Of course, it doesn't, but it will perform work which has hitherto been done only by human brains. A device belonging to this exceedingly twisted class is a tabulating machine in use at the Census Bureau in Washington. It draws important lessons from data that are first recorded by the punching of cards. All of this preliminary work can be done by girls and for a time the cards are filed in convenient cases or drawers. Subsequently a lot of them are fed into the machine miscellaneously and certain ones will be automatically sorted out. These, on examination, will tell an important story; that is, if the proper adjustments have been made for selection.

If this system were in use in a big engine factory the punching would run something like this: One hole would indicate, by its place in a possible column, the year, a second would record the month, and a third the day. There would be several more imaginary columns, in each of which at some point one hole would be punched, the position being dictated by circumstances. These additional holes would tell the

number of the job, the number of a particular operative who worked on it, the hours he spent on it, and his wages. It would also be possible to show whether this was piece work or not, whether it was for a customer or for the house, and other facts that might be of importance.

Suppose, a year or two after the punching was done that the manufacturer wanted to know why one engine which he had turned out cost less than an earlier one. His machine could then be made to pick out from a large number of cards the very ones which registered the facts he wished to learn. In a few minutes he could get what it might take a bookkeeper several weeks to find. —*New York Tribune.*

Heavy Atlantic Type Engines for the C., B. & Q.

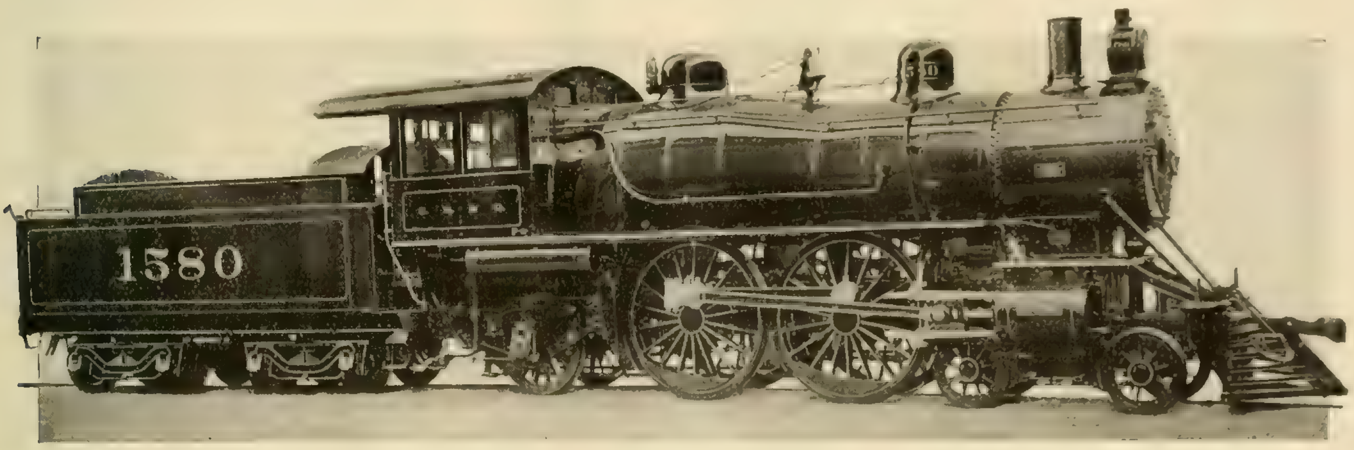
The Rogers Locomotive Works, Paterson, N. J., have been turning out some very fine 4-4-2 engines for the Chicago, Burlington & Quincy Railroad. They are to haul the famous "Burlington No. 1" and other trains of that class, so that work is already cut out for these machines. The engines are simple, with 20x26-in. cylinders, 84 1-2-in. drivers, the adhesive weight is 92,000 pounds and the pressure carried is 210 pounds. The total weight of the engine is 174,000 pounds.

The rear truck wheels, which are 54 1-4 in. in diameter, have outside journals which are 12x8 ins., and are enclosed in a journal-box with dust-guard brass and wedge on the same general lines, though larger, as the regular M. C. B. axle box. The use of this box necessitated a special frame arrangement. The main engine frames terminate in a steel casting which acts as a very solid filling piece between the frames, and the casting extends out far enough to spread the frames for the rear truck so as to pass them over the center of the axle box when in normal position. The box slides in frame jaws similar to those of the driving wheels, but considerable side play has been allowed for. The equalizer for the rear wheels rests upon the top of the box and terminates in a pair of spiral springs at the back and connects with a pivoted equalizer bar which connects with the rear driving spring hanger. The driving wheels are equalized in the usual way with overhung springs.

The valves are of the piston type and are placed directly between the top and bottom bar of the frame front, thus giving short direct steam passages to the cylinders. The valves are 12 ins. in diameter, and the packing rings are put in what may be called spoked bull rings, which are held in place at each end by the valve-stem with shoulder and nut. The transmission bar passes over the axle of the leading driver and is attached to a rocker with both arms on the same side of the center, thus securing direct action for the valve. The cross-head is of the two guide-bar type and is secured to the piston-rod by a nut.

The boiler is of the wide fire-box type, with extension wagon top. The inside diameter at the smoke box end is 64 ins. The heating surface amounts to 2,990 sq. ft., and the grate area is 44.2 sq. ft. A few of the principal dimensions are as follows:

Cylinders, 20 x 26 in.
Driving wheel base, 7 ft. 3 in.; total wheel base of engine, 27 ft. 7 in.
Weight on drivers, 92,000 lbs ; weight on truck, 42,000 lbs.; weight on trailers, 40,000 lbs.; total, 174,000 lbs.
Heating surface—Tubes, 2,834 sq. ft.; firebox, 156 sq. ft.; total, 2,990 sq. ft.
Grate area, 44.25.
Tubes, diameter, 2 in.; length, 16 ft. 6 in.; thickness, No. 11; number, 330.
Grate, length, 96 in.; width, 66 in.
Wheels—Engine truck, diameter, 37¼ in.
Tender—Capacity, 6,000 gals.; frame, wood with steel center beams; trucks, with cast-steel bolster; wheels, diameter, 37¼ in.



HEAVY "ATLANTIC" TYPE ENGINE FOR THE C., B. & Q.

Throttle Valves Ground by Air.

At the new Reading shop of the Philadelphia & Reading they grind throttle valves by the use of compressed air. The throttle case is clamped against a bench and a pneumatic boring or reaming machine operates the valve, which is made to spin round at a good speed. In order not to cut the seat in a series of concentric circles, as would likely happen if continuous motion were kept up, a neat device simulates the little jump off the seat which a workman gives to the valve every little while, when grinding by hand. The device is a treadle, which when pressure is applied by the foot, raises a small ram which strikes a temporary throttle stem. In other words, while being ground in, the throttle valve is opened and closed by the foot of the operator, just as the engineer opens and closes it with his hand on the regulator, when the throttle is in its own legitimate business of steam choking.

Two Little Tooters.

Two of the little Manhattan Elevated Railroad engines, which have for years glided past masses of struggling and crowding New Yorkers on the "L" platforms, will shortly make a start for China. The American-China development Company is about to begin work on the Canton-Hankow Railroad, which will eventually be about 900 miles long, and these little hard-coal puffers will be required to do some construction work. We are afraid that they may not be nearly as particular or well behaved out there as they have been here. In the city they are most careful not to let the water from their injector overflow pipes fall upon the street below, nor that any hot cinders shall get out of their ash pans. Who can tell what they may do when away from home for the first time and working on construction, but surely a pair of snorters, who can constantly be "out all night" in New York and yet keep a fairly straight course from the Battery to Harlem, may still, in a foreign land, do credit to their American bringing up. They have been trained here, in making "chalk-line" stops with the vacuum brake, and they may "spot" cars in China in a way which may make even the Celestial Empire look earthly.

General Correspondence.

Locating a Blow.

Reading the article, "Combination of Book and Brain," written by Bro. "Shandy" for the March number of RAILWAY AND LOCOMOTIVE ENGINEERING, I find a mixture of conditions; that is, there is a mixture of the ancient and modern that does not blend; this cuts no figure, however, with the good results which should come from the articles written on the subject that the brother has mentioned. In the days of long ago, and before the advent of correspondence schools, the old balloon, sunflower and diamond smokestacks were in evidence; this long ago was a full quarter of a century back. In those days it was a short job to open up the smoke box and slip a shingle over the nozzles to locate a valve blow. Beginning fully 20 years ago the mechanical heads of various locomotive departments were taxing their brains to get up some device to husband the cinders, and the extension front end was born as the fruit of their labors, and it did the work, and the results—well, every old-time railroad man knows the results. Anyhow, the extension front was universally adopted and, with its adoption, it became about as hard a task to get into a front end as the average railroad man will find in trying to get into heaven. After the coming of the extension it was about as easy to take off both steam chest covers as to get to the nozzles, and this condition led me to adopt the "Stick telephone" to locate valve blows. I will describe this method (although if my memory serves me right, I read an article in RAILWAY AND LOCOMOTIVE ENGINEERING on same subject some time ago): take a piece of wood about 1-2 inch in diameter, 2 or 3 feet long, grab it firmly between the teeth (if you have teeth), close both ears and place the end of the stick farthest from you against the steam chest proper, that is, do not rest stick against the jacket covering, but against the chest where release valve is screwed in, or at back end, close to stuffing box; place your engine where blow seems strongest and use this "phone" first on one side then the other, and you can easily distinguish the side that gives forth the greater volume of sound. I have never failed in this method of locating valve blows, and if there is any one thing more than another that an engineer should know these days it is how to locate a valve blow, and I believe it possible to locate this trouble in almost every instance if a little care and patience are exercised.

J. W. READING.

Manistee, Mich.

To Prevent Telescoping.

My attention has been called to an article on page 76 of your February issue in which you discuss the merits of a certain non-telescoping car patent recently issued to me.

I have read the article with much interest, and the objections mentioned by you have been mentioned by others. I have done a vast amount of traveling and have had the misfortune to be in several railroad wrecks, but the good fortune to escape injury myself. One thing that has impressed itself upon me, and which, in fact, set me thinking along the line which developed the non-telescoping idea was the fact that the simple derailment or even ditching of entire passenger trains often happens without the loss of a single life. I have kept track of railroad wrecks in recent years, and it is the exception for more than one or two persons to be killed in derailed cars, and generally these are the engine crew or trainmen. On the other hand telescoping accidents always result in fearful loss of life. More than one hundred and fifty passengers were killed in telescoping wrecks within a period of thirty days this winter. The reason for this is the crushing or telescoping of the cars, and there is little chance of escape. When cars are derailed or rolled over, passengers are bruised up, but as long as timbers and other cars do not enter the car in which the passengers are riding, the chance of fatal accident is not very great, and the non-fatal injuries that happen are, as a rule, not serious.

I note your statement that "the elimination of the car platform and the introduction of solid end cars and continuous vestibules with strong underframing to cars, is apparently the safe lines along which the evolution of car design by expert car builders on our leading roads is moving." Of course it is a fact that the solid end cars do not prevent telescoping. I know a number of instances where solid vestibule cars have telescoped and there is no reason to believe that they are safer than any others. The only tendency of "solid ends and strong underframing" is to withstand and check the momentum by main force, and if this could ever be accomplished—that is, if on account of the strength of the cars it would be possible to bring the entire train to an instant stop without telescoping—the effect would indeed be disastrous.

A train running at 30 miles an hour is traveling 44 feet a second, and if it were possible to stop the entire train as suddenly as the engines stop in a train would strike the object directly in front of him with the same force that a man would strike the sidewalk after jumping out of a fifth story window, as his body would be going thrugh space at about the same rate of speed (44 feet a second) when he struck the sidewalk that the passenger is traveling when the collision occurs.

I maintain that it is a physical impossibility to stop a train in this way, as the tremendous energy or momentum must be given a chance to spend itself. When a collision occurs the forward cars crush together and the rear cars on account of this crushing come to a stop within a car's length or two, and this is the only thing that saves them or the passengers in them.

The theory of my invention is that it is absolutely necessary to provide one or two hundred feet within which to bring the cars to a stop so that the momentum of the train can spend itself. This is made possible by dislocating one or more joints of the train and throwing the cars aside in the way provided by my invention.

Strong underframing of cars or strong ends never have and never can prevent telescoping, and even if they could the shock would kill everyone in the train.

GEO. E. DICKSON.

Chicago, Ill.

Outrages to American Trainmen in Mexico.

I cannot refrain from replying to your article in the February number regarding outrages to American trainmen in Mexico.

Among all the articles in print in the United States there are none from any trainmen now in prison in Mexico, and if any were deprived of their liberty here, surely the organizations of conductors and engineers would know it. H. H. Adams, who, by the way, belongs to neither organization, is well known here. He was in a position he had no business to be in, caused the wreck himself, was well treated, considering the opportunities that existed in a little mountain town, and instead of "flagging a train with a match and being smuggled out of the country" he rode out on the express of the National Road with a purse of money in his pocket. The conductor and engineer with whom he rode are still on the same train.

Nor are the agitators against our Minister and Consuls among the American residents here. I personally know of cases where our Minister has interceded for railway men here, and secured their

release, but you must not forget, it is not a Minister's business to uphold those who transgress the laws of a country.

M. J. SCHNEIDER,
M. M. Nat. Ry.

Heat Phenomenon in Fire Box.

In answering the question of W. B. Chenowith, of Cotton Belt shops, in January number of the RAILWAY AND LOCOMOTIVE ENGINEERING, regarding the phenomenon of cold fire-box sheets when the engine is hot, will say that this is due to the law of convection. It is a very important study for engine crews. It cuts no small figure in cracked sheets, leaky stay-bolts and flues. When steam is raised in a boiler and the injector put to work with a good fire in fire-box, the water in boiler is in continual motion by currents. The cold water passing in currents down the sides of the fire-box sheets. These sheets being splendid conductors of heat, the heat from the fire readily passes through the sheet in to the cold water, which is converted to steam and passes in currents through the body of the water to the surface. The water absorbs the heat so rapidly that it keeps the sheets comparatively cool. If W. B. C. will shut off the injector long enough for all the water in boiler to become hot and allow the fire to cool down he will find the sheets would be too hot for his hand. Convection keeps the heating surface of boilers from being destroyed by heat, by communicating the heat of the fire-box to the water, which is carried to the top of the water in currents, and replaced by cold currents of water descending from the top. The practice of some engine crews putting on the injector with full feed of water for a short time, shut it off for a short time, and then again on full, and thus continue over the road is very hard on the heating surface of a boiler. The continued expansion and contraction of the sheets and tubes causes cracks in sheets, and leaky stay-bolts and tubes. The boilers should be fed as evenly as possible, for the above reasons.

JNO. A. ROSS.

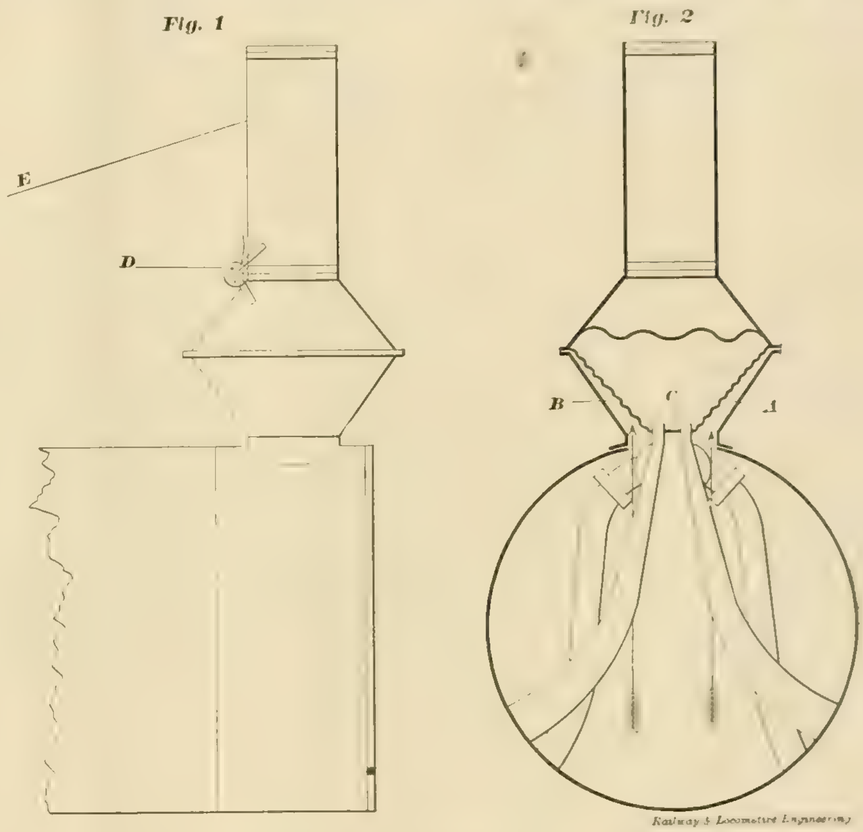
East Las Vegas, N. M.

Mr. A. M. Waitt, superintendent of motive power and rolling stock on the New York Central Railroad, has a few days ago issued the following circular addressed to the employees of the mechanical department: "Having decided to sever my connection with this company after March 31, I desire to express my appreciation to the employees of my department for their good will and co operation for the past four years. In no way can your good will for me be better shown than by giving to whoever is selected as my successor the same support and loyalty that you have accorded me. In retiring from the road I leave with you each and all my best wishes."

Spark Arresters.

It was with a great deal of interest that I read the article on spark arresters, contributed by Mr. J. Snowden Bell, in February issue of RAILWAY AND LOCOMOTIVE ENGINEERING. The same old hustle to prevent throwing fire and have the engine steam obtains to-day, as it did in my boyhood days. Among the many devices illustrated in the columns of your journal from time to time, I have never seen this old stack mentioned, and of which I enclose sketch. Where this stack originated "deponent saith not." At all events, it was the only one used for a number of years on the old Philadelphia & Columbia Railroad (Pennsylvania State Road). It came into use on the old single driver engines, and held its own long after the era of multiple coupled engines, on the State Road. Fig. 1 shows a general outline of the stack. Fig. 2 shows the front removed, exhibiting the arrangement of steam and exhaust pipes. A part of the smokestack casing in Fig. 2 is broken away to show the netting A in the lower part of the stack. The netting, like the bottom part of stack, was an inverted frustum of a cone.

Between the casing and the netting was the space B. The exhaust tips entered the bottom of the netting, which was in reality an iron plate (C) having holes for the admission of the exhaust tips. Any cinders carried out of the front end by the force of the exhaust moved in the line indicated by the arrows. The relation of the moving cinders and angle of netting is very much the same as obtains in modern practice. These old stacks did not in a general way throw much fire, considering the kind of fuel used (wood and coal combined, and the engines were good steamers. It was the duty of the fireman at all water stations to clean out the front end, and they are doing the same thing to-day, with extension front ends. The old engines had boiler-iron fronts; to-day they are steel. In Fig. 1 you will notice the rod E connected to the left side of the stack, and near the top; also at D what appears to be a small wheel, is a coiled spring and hinge combined. The top section of the stack is jointed at this point, the rod E leaning back to the left side of the engine, it was another duty of the fireman to lower the stack when going through all covered bridges, on account of the bridge roof being too low. Firemen have lost their lives by forgetting to lower the stack in time, the bridge striking the stack and driving the rod through the man's body. Steam and exhaust pipes were made of copper, and being directly in front of the flues, they had to be protected by a sheet-iron jacket. These sketches are made from memory and are practically correct. The motive power consisted of engines built by Baldwin, Norris, Eastwick & Harrison and Campbell, all of Philadelphia;



OLD PHILADELPHIA & COLUMBIA R. R. SMOKE BOX.

Dotterer & Co., of Reading, Pa.; Pennel, Leonard & Hume, of Lancaster, Pa., and they all used this stack. Who can tell the readers of RAILWAY AND LOCOMOTIVE ENGINEERING more about it?

W. DE SANNO.

815 Van Ness Ave., S. F.

Smoke Box Arrangement for Modern Locomotives.

Much has been said in regard to the adoption of a standard form of front end, but it would seem that the result of efforts in this direction would be sufficient to demonstrate that such a plan would not be practicable for all kinds of service and conditions existing in different localities. What we need is efficiency, economy and simplicity. Free steaming engines that can be run with a reasonably large exhaust opening. By simplicity is meant to do away with all adjustable parts in the construction of front end if possible, and when one engine of a class is found to steam satisfactorily after thorough trials, and under all prevailing conditions, with a certain size nozzle and front end adjustment, make the latter non-adjustable. And all the other engines of this class should be arranged like it. Any further changes of these parts will not improve the steaming qualities of the engine. How often we see a case where the engineer reports an engine not steaming, without assigning any cause for it. The engine-house foreman makes alterations in the front end without any apparent reason for doing so, which usually consist of moving everything that is movable, and winds up with either bridging or bushing the nozzle, and the real cause of trouble which is probably a loss of steam or something more that interferes with the proper work of engine is not thought of at the time. The engine goes out on the road and with the very strong blast on fire and increased fuel consumption, probably a sufficient amount of steam is generated to overcome the existing defect and the engine makes a very successful run. One will only have to talk with the engine-house foreman on the subject and he will look wise and tell you that he made the 796 steam. Meanwhile the engine continues in service with the original trouble getting worse, until finally it is unable to do business and is ordered out of service. The trouble now must be located and the cylinder packing, valves, etc., are examined. Perhaps the cylinder packing will be found to be defective or even worse trouble found, as is often the case with compound engines. The defective ports are repaired and the engine again goes into service, but the mutilated front end remains as the engine-house foreman left it. It only takes a few experiences of this kind and the unsatisfactory performance of the engine becomes noticeable

However, it is a fact much to be regretted that we not infrequently find well proportioned modern locomotives so choked up at the exhaust opening as to render their performance unsatisfactory, particularly so as regards fuel consumption. In taking up the different parts contained in the smoke box for consideration, let us look at the deflector and diaphragm plate. We find that it has taken the place of the draft or petticoat pipe used in the diamond-stack engine to regulate the flow of gases through the flues, thus distributing the draft evenly over the grate and utilizing all the heating surface represented in tube area for making steam. The question arises, and I believe is yet to be decided, as to what this plate should be, and its location. In my opinion the deflector and diaphragm plate should be all in one, non-adjustable and placed back of exhaust pipe, with sufficient space between it and flue sheet to equalize the flow of gases through all the flues. It should be placed at a long angle reaching to exhaust pipe, the height of the latter being determined by it, and a short front end should be used that will not allow sparks to accumulate beyond the path of the current of gases passing up to the stack. The height of exhaust opening can be governed by nozzle tip, as it can be carried to any height desired. Just what advantage there is in using a draft pipe with a deflector plate is not quite clear to the writer, having been familiar with many excellent steaming engines without it, and I would like to see trials made with some of our modern engines to demonstrate whether or not it is a necessity. At any rate the pipe or pipes should be non-adjustable. In my opinion the diameter of stack should be governed by the amount of grate area, kind or service and quality of fuel used, and I would not be surprised to yet see 20-inch stacks used on high-speed wide firebox engines burning gaseous fuel. The question of the exhaust filling the stack does not seem to be of as much importance under the above conditions as that of allowing the unconsumed gases to pass out with it. At very slow speed and with fuel containing a less amount of gas it will be found necessary to use a smaller stack in order to obtain a sufficient amount of vacuum. I believe it is a well understood fact that the unconsumed gases in front end must have room to pass out of stack with the exhaust. Otherwise they act as an obstruction of the draft and the engine does not steam satisfactorily. The question of front end filling up with sparks is a very troublesome one, and as there is no advantage in collecting them, the front, as I have before stated, should be short. Usually trouble of this kind can be traced to inexperienced firemen or small exhaust nozzles. In case of the former where the fire is being fed too fast and is being continuously stirred up with the fire-tools, large quantities of partly consumed fuel in the shape of sparks are carried through the flues and the same can be said of the small exhaust nozzle. A moderately coarse netting gives best results. Fine netting should not be used, as it acts as an obstruction to the passage of gases and it is necessary to use a small nozzle tip in order to get enough blast on the fire. In addition to other disadvantages this produces a sharp, jerky exhaust which throws more fire than with a coarse netting and larger nozzle. There is no disadvantage in throwing out the dead sparks that find their way into the front end. With a mild exhaust and free-steaming engine most of the sparks are consumed in the firebox and go toward producing steam. What few do pass through the flues do not do so with a rush and are usually out by the time they reach the stack.

W. A. BUCKLEE.

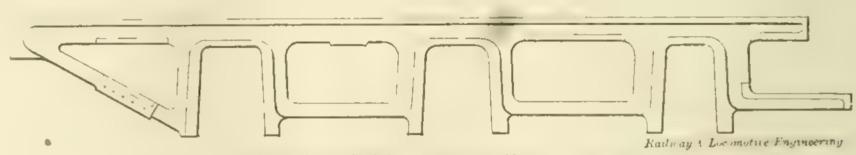
Rensselaer, N. Y.

Planing Cast Steel Frames.

Noticing that the steel fram is coming thick and fast, also bringing with it hard work for the planer-man to properly turn out a good job, sand and lots of it coming with frames, why don't they reduce the surface to machine as per my sketch, loosing lots of sand holes and reducing time to plane.

F. RATTEK.

Manchester, N. H.



PROPOSED STEEL LOCOMOTIVE FRAME.

[What our correspondent is hoping for, is being put in practice by several leading roads. The reduction of machine work on cast steel frames is one of the objects which modern designers have constantly before them.—Ed.]

The First Successful Coal Burning Locomotive.

Though never having been employed in any branch of railroad work, I have from a child been interested in railroads, and have noted the development of locomotives from the old woodburners I recall in the sixties to the productions of the present day. Having recently made somewhat of a study of the origin and growth of American engines, I am

pleased to see the series of articles by Mr. Sinclair on this subject now appearing in RAILWAY AND LOCOMOTIVE ENGINEERING. I have gathered pictures and descriptions of historic engines, most of which are the originals of the numerous types that appeared at intervals of from three to five years, from 1803 to the seventies. Of the early American engines made at the West Point Foundry, and by Baldwin, Jervis, Campbell, the Lowell Machine Shop and others, the first engine to have a cab, at least the first so far as I have been able to learn, was the Norris eight-wheeler No. 16, of the B. & O., in 1838. But after this date Norris seems to be about the only American builder to discard the cab, as appears by pictures of his ten-wheeler the "Chesapeake," in 1846, and the Norris-Phleger of 1855. An explanation has suggested itself for this singular fact by the possibility that the cab, which looks modern enough, was put on some time after the engine was built. I have two pictures of this engine obtained from different sources and from different sized plates, and they are alike. Perhaps I am not the only engine crank who has sought an answer to this conundrum. Coming down to a later date I find there are as many "first successful coal burners" as "oldest Masons" or articles of Mayflower furniture. In a series of papers by Mr. S. M. Vauclain entitled "Locomotives of a Century," which appeared in *Popular Mechanics* (Chicago) last spring, I find in the issue of May 3rd Ross Winans' "Delaware," 1846, spoken of as "the first locomotive to burn anthracite coal successfully, and this enabled the Reading Railroad to haul coal to Philadelphia by burning coal instead of wood." In the next number of the same paper, May 10, 1902, we read: "We now come to the first engine to burn anthracite coal, which marks a distinctive step in the wonderful evolution of the locomotive." "It was Millholland's 'Illinois,' shown in Fig. 25" (1852). On reading this I thought of the entertaining article in RAILWAY AND LOCOMOTIVE ENGINEERING of last August entitled "The First successful Coal Burner and Modern Successor," which gives an account of Mr. Felton's final success with coal on the "Daniel Webster," of the P .W. & B. road, some time in the sixties. So this matter of first successful coal burner seems to be a case where the doctors disagree.

JAS. M. KIMBALL, Woburn, Mass.
76 Garfield Avenue.

[Really the first locomotive to burn anthracite successfully was Peter Cooper's "Tom Thumb." There is no question about that as a fact. The grasshopper engines designed by Phineas Davis and Ross Winans also burned anthracite.—Ed.]

Boiler Explosions.

I not only was pleased with, but heartily indorse the views expressed in the March issue relative to boiler explosions.

I go a step still further. My belief for years has been that every State should force on locomotive engineers a license and examination. Also every company should be forced to put in the hand of every man hired as foreman a short, comprehensive treatise on combustion, steam and boilers.

Every man knows just how far his particular company expend time and money in caring for the motive power, so setting all complaints against the companies aside for brevity, let us consider the chances some men take.

So many possibilities exist wherein a man can get caught low in water and touch his sheet that in numerous cases I can heartily sympathize with the unfortunate one. Firing for a man who warped the crown and caused a number of stays to let go, I can testify to unpleasant sensations.

There is a limit to the elasticity of iron and steel, and for years I have been inclined to believe the mysterious part you speak of in a number of cases has been by some men stretching the limit.

There has been and there are men who to make a good run, or to overcome a hard pull or to make a little faster time than some other fellow, will crowd the safety line. Then there is another type.

You will see him with a free steaming engine trying to overcome the last part of the grade. The engine struggling, straining, swaying, every fiber in her seeming to quiver like a thing of life. Her safety valves up and he closes off his water to force her just a little more. When I have been ordered to leave a door shut under such conditions I have thought: Will she stand the strain of what she is using if he shuts off suddenly. Then there is the fireman who, against repeated instruction, will not watch his steam. And there are some others. Sometimes mufflers does not relieve. I have seen from 10 to 30 pounds excess of pressure when shutting off. An engineer cannot always reach the firebox door.

One very foggy night, taking an extra engine on a passenger run, and while passing over a section of road where signals were thick and strict attention to them requisite, I was leaning out of side window when the thought came to me: This is a pretty smart engine for one allowed only 130 pounds of steam. Well, when I passed the next "clear" I pulled the old broken hand lamp a little nearer the steam gauge. 175 pounds of steam ! Not a simmer from relief, both doors shut tight. If I had shut off suddenly I wonder if I would have passed the "clear" except perpendicularly.

MODERATION.

Squaring the Exhaust.

I see that F. V. B., in the March issue of RAILWAY AND LOCOMOTIVE ENGINEERING, asks to see how I could keep a plugging bar in the nozzle when he could not keep his liner in the stack. One thing he has not taken into considerating is the vast difference in area between a ¾-in. bar and the liner he mentions, which I should judge was about 16 in. in diameter, as he gives no figures.

I have not only once, but dozens of times seen the bar used as I described in the January issue, for the purpose of making engines steam that were failing on account of a poor tank of coal. I have also seen brake-wheels inserted in a taper stack for this same purpose, but never yet found that the exhaust would dislodge and blow them out of the stack. From the description he gives of the antics of Engine 109 I should judge that the exhaust and cinders had worn off the rivets and cocked the false stack, giving him the results he mentions. Now, the only fault I can find with him was that he did not extend his thoughts far enough, due probably to loss of sleep, long hours, etc., and put too much reliance on the shop force to locate the difficulty for him.

While traveling engineer for the Ohio Central Lines I had a case identical with brother F. V. B., and when the engine went lame she quit steaming. The engineer wired in for permission to give up his train and come in with the light engine. Knowing him to be a very capable man I refused to grant his request until he had made a thorough examination of the cause, realizing that if the shop force should find a cause which might have been remedied out on the line with the resultant delays and expenses incurred, it would have reduced his stock as an able and competent engineer in the estimation of the company considerably.

I went out on a departing train to meet him. We opened the smoke-arch door and found a liner dislodged and cocked in the stack. After removing the same the engine steamed free again. I found upon inspecting our other engines four others that were about ready to cut up the same capers. Now, our liners were not put in to reduce the stack, but to protect the stack from the wear of cinders.

We removed them all and experienced no more trouble from this source. The engineer also, in the case just cited, not only brought in his train, but saved the expense incurred in your case of having the shop force go over the valve motion and finding nothing wrong with it.

J. A. B.

All good ends can be worked out by good means. Those that cannot are bad, and may be counted so at once and left alone.—*Barnaby Rudge.*

Railway and Locomotive Engineering

A Practical Journal of Railway Motive Power and Rolling Stock.

Published monthly by

ANGUS SINCLAIR CO.,

174 Broadway, New York.

Telephone, 984 Cortlandt.
Cable Address, "Loceng," N. Y.
Glasgow, "Locauto."

Business Department:
ANGUS SINCLAIR, President.
FRED M. NELLIS, Vice President.
JAMES R. PATERSON, Secretary.

Editorial Department:
ANGUS SINCLAIR, Editor.
F. M. NELLIS, GEO. S. HODGINS, JOS. A. BAKER, Associate Editors.

Advertising Department:
Eastern Representative, S. I. CARPENTER, 170 Summer St., Boston, Mass.
Western Representative—J. A. BAKER, 1204 Monadnock Block, Chicago, Ill.

British Representative:
THE LOCOMOTIVE PUBLISHING CO., Ltd. 102a Charing Cross Rd., W. C., London.

Glasgow Representative:
A. F. SINCLAIR, 7 Walmer Terrace, Ibrox, Glasgow.

SUBSCRIPTION PRICE.

$2.00 per year, $1.00 for six months, postage paid to the United States, Canada and Mexico. For other parts of the world, $2.50, or ten shillings. Single copies, 20 cents. Remit by Express Money Order, Draft, Post Office Order or Registered Letter.

Mailing address can be changed as often as necessary—always give old and new address, and if you subscribed in a club state who got it up.

Please give prompt notice when your paper fails to reach you properly.

Entered at Post Office, New York, as Second-class mail matter.

Block Signaling in the United States.

In the proceedings of the session of the American Railway Association held in New York on April 23 and 24, 1902, some very interesting statistics on block signaling are given, and from them some very instructive lessons may be learned. It appears from the table published that there is a distance equivalent to 34,175 miles of single track which is equipped with block signals. The total mileage represented by the association is given as 200,154 miles. The report of the Interstate Commerce Commission gives the total mileage, including single, double, treble and quadruple tracks in the United States on 30th June, 1901, as being 210,437 miles, and this does not take in yard tracks, which, if included, would bring the total up to about 265,325 miles. In this survey of the facts no account has been taken of the interlocking signals used in yards, though it may be stated that 83 roads use them and there are 24,057 such signals in use.

In dealing with the block signal statistics it seems fair to take the Interstate Commerce Commission's figure of 210,437 miles as the total number of operated miles equivalent to single track to which block signals might be applied. This means that there are 176,262 miles of such track without block signals. If we choose to designate roads using block signals as protected roads, we find that there is more than six times as much unprotected mileage as there is protected. In other words, about 16 per cent. of the total operated mileage which we have considered as equivalent to single track, is all that this country can boast of in the way of block signal equipment, and according to the Railway Association its use was confined to 53 roads at the date given.

The reason why such a small percentage of block signals is used, is not far to seek. In the early days of the development of this country the principal thing was to build and work a railroad, without any of the refinements in operation which the needs of these latter days are beginning to force upon us. We have passed out of the simple developmental period in which railways of the crudest type were in advance of the needs of the people. We are now well into what may be called the "Can-you-handle-the-business-offer d" stage, in which existing transportation facilities are often severely taxed to meet the normal and perfectly reasonable demands of the country.

The motive power departments of our railway systems seem to have kept more nearly in touch with the changes time has wrought. We have to-day large, high-speed passenger engines, capable of hauling fast through trains and of maintaining schedule time. We have also heavy freight locomotives of modern design, developing power sufficient to move cars with maximum load, in long trains. Not only has adequate power been provided, but the "large car" has helped to reduce transportation to a low cost per mile. Further than this, motive power departments all over the country have been rebuilding and modernizing their repair and maintenance plants. These excellent results may briefly be summarized by saying that the motive power department is abreast of the times, but the fact nevertheless suggests a comparison.

We have something over 210,000 miles of good track in this country, let us say; we have modern engines and cars and we have repair plants adequate for the service required, but in every 100 miles of this track on which these engines and cars run, there are about 84 miles unprotected by block signals. This fact is all the more remarkable when it is remembered that the steadily increasing business which has made equipment of engines, cars and repair plants, grow larger and larger, does not appear to have materially stimulated the use of block signals, although the block system and track capacity are very closely related matters. Just here it is interesting to quote the *New York Evening Post* of recent date, where it remarks: "The preponderance of evidence leads us to believe that the trade of the country has actually outrun its means of transportation, and that the shortage is not merely of cars and locomotives, but of trackage as well." When looked at side by side, these facts as stated above seem to indicate that the operating department on our railways can hardly have taken block signaling seriously.

As time goes on and as incidents in the operation of railways come more and more under the notice of the government statistician, deficiencies in equipment or defects in maintenance and operation will come more prominently into view in every published report. As the searchlight is gradually turned on the cause and relative seriousness of accidents, it will be found that train movement, not engine failures, is casting the darkest shadow.

It has been customary in the past for technical men and others in this country to criticise railway management in England and to dwell with perfectly justifiable satisfaction on American cost-reducing methods. Perhaps this criticism has failed to recognize some of the details of the work which our friends across the water are doing in the matter of safe, even if not cheap, transportation. They hold the record for the successful movement of an enormous number of persons, with minimum loss of life. They achieve the desired result in general by a method of train movement which includes some form of block signal or train staff system, and the enforcement of such discipline as serves to make these devices effective.

The Battle of the Gauges.

The origin of what is now called standard gauge of track, viz.: 4 ft. 8 1-2 ins., was not due to the adoption of any scientific standard, nor had that width of road been determined by any mathematical process. The original width of ordinary road wagons and the coal trams in the north virtually determined the British track gauge. It was adopted because its use had already been established. George Stephenson had all his life been accustomed to this distance between the rails of the colliery track where he worked, and he introduced it on the Liverpool and Manchester Railway when acting as engineer for that line. He believed it to be "the most economical in construction, not only as regarded the engines and carriages, but more particularly of the railway itself." In fact, in the matter of railway gauge, Stephenson showed himself to be a man of extraordinary foresight. He believed in the 4-ft. 8 1-2-in. gauge as the desirable standard, and fought for it all through his life and educated his son Robert to believe in it most firmly. On one occasion when Stephenson the elder was consulted as to the gauge of two railways, the Canterbury and Whitestable

line, and the Leicester and Swannington Railway, he said, "Make them the same width, though they may be a long way apart now they will be joined together some day."

History tells us that before the days of the Stephensons and as early as 1776 cast iron flanged rails very much like what we call angle-irons, with the vertical faces on the inside, were nailed to wooden sleepers at the Duke of Norfolk's colliery, near Sheffield, in England. John Curr designed this primative track. In 1789 William Jessop built a railway at Loughborough, Leicestershire. On Jessop's line the wheels were flanged and the rails plain. In 1800 Mr. Benjamin Outram, of Little Eaton, in Derbyshire, used stone supports instead of timber, for carrying the end of the rails, and some writers have endeavored to connect his name with the origin of the word tram-way, or tram, which latter is used to-day in Great Britain to designate a street car. Benjamin Outram is probably more widely known to fame as being the father of General Outram, who, with Sir Henry Havelock, was concerned in the relief of Lucknow during the Indian Mutiny. In this connection it is interesting to note that the Standard dictionary gives as one of the meanings of the word tram that it is used in Scotland to indicate a bar or shaft, beam or thill. The handles of a plow were from very early days called trams, north of Tweed, and the man who held the handles and walked between them as he guided the plow was designated as the "in-tram-man," while the man who walked alongside driving the animal was naturally enough the "out-tram-man." The word out-tram shortened in time to outram, eventually became a family name just as Smith and Carpenter have, and the name Outram was probably, by accident, borne by the man who introduced stone supports under the rails instead of the timber previously used.

When Robert Stephenson began to take the place so long and honorably held by his father in the growing railway world of Great Britain, there were many and fierce contentions as to the best width to use between the rails. Robert Stephenson's rival, Brunel, opposed what was then known as the narrow gauge, upholding most spiritedly the advantages of the 7-foot track which he had recommended to the directors of the Great Western Railway. The Stephensons, who were inventive, practical, sagacious and naturally conservative in the best sense, stood for the 4-ft. 8 1-2-in. gauge as a standard, and a gauge which possessed the merit of economy, but they were nevertheless spurred to greater exertions in fighting for the maintenance of existing practice than they would have been without the powerful opposition of the talented Brunel. When the Eastern Counties Railway was built Braithwaite, the engineer of that line, adopted 5 feet as the gauge of road, as he thought it best for the purpose of giving space for the machinery of his locomotives. When the northern and eastern extensions of his line came to be built he adopted the Stephenson gauge for the purpose of securing uniformity where these lines connected with the narrow gauge of the Midland. Brunel, in championing the broad gauge Great Western line, sought with his ingenious, imaginative and daring mind to secure the best railway which could be built, while the Stephensons, adopting a safer course, endeavored to construct a line which would pay. As a matter of fact, Brunel's line was not satisfactory in a monetary point of view to the shareholders, but as the historian of these early days has pointed out, Brunel's ambitious designs may have caused individual loss, but they nevertheless gave to mechanical invention at the time a powerful stimulus which resulted in great good to the nation at large.

American and Foreign Locomotives.

For many years it has been a favorite occupation with friends of foreign locomotive design to claim for those machines an economy in fuel consumption over those of American build. What there is in this contention must be left unrefuted, since we are not in possession of any records of competitive trials between the two products—such trials being the only way to satisfactorily determine a matter of such weighty import. There is this in these claims, however, that vibrates harshly on the sensibilities of the American designer, and that is, that the foreign machines furnish a horse power on a heating surface that would be far too low for use in this country. The reason why those engines are successful with proportions that would fail to give results here is covered by many dissimilar factors in the respective conditions, if true, but is it not possible that the smoke-box arrangement is one vital factor, since no foreign builder looks with favor on our scheme of choking up the front end with a mass of netting and deflecting plate, and afterwards making a weak attempt at reparation by reducing the nozzles enough to overcome the obstructions so carefully planned. This practice is ancient history here, but it never obtained a foothold on the other side of the Atlantic. It is a fact that the foreign engineer regards our methods of drafting locomotives as not entitled to serious consideration.

Cylinder clearance in the American engine may also come in for its share of responsibility in this matter of fuel consumption, our engines being notorious for excessive clearance in the ports, this amount being from 7 to 14 per cent. of the piston displacement for slide valves and piston valves respectively. This is certainly a strange practice to perpetuate, when its evil effect is so well understood, but it is only just to say that one late piston-valve design has shown a radical improvement in this respect, bringing the clearance down lower than on the average slide valve. Foreign designers look sharply to this ratio, for they know as well as anybody that anything that will reduce the water consumption per horse power hour is conducive to fuel economy. This popularity or fad of the piston valve may have another bearing on the fuel question which might prove of advantage to us to investigate, namely, the intensity of pressure of the rings against the steam chest walls, by which the internal friction of the engine is increased, for there are few piston valve rings that do not have a surface on which the steam pressure cannot be exerted to force the rings outwardly. All claim the ideal frictionless piston valve, but how many attain a realization even approaching it?

In experiments to determine the conductive efficiency of different metals for water heating surfaces, according to Hutton, in "Steam Boiler Construction," it is shown that copper has a conductive value equal to practically twice that of steel—the surfaces of each metal supposed to be clean. This information may be interesting as affording a partial solution of the superior capacity of the foreign boiler, which almost invariably has the copper firebox, and either copper or brass flues. Steel fireboxes were tried and abandoned on English roads several years ago on the ground of lack of durability, but it is probable the transmission of heat had some bearing on the action taken. There is yet one other factor to be considered in the case—that of fuel—a point of primary importance. It is well known that the coal used in England has a higher calorific value than our own bituminous product. Seven pounds of water per pound of our coal is recognized here as a good evaporation, while the average is five pounds and under. To find coal abroad as low as this in evaporative value is an exception, and when it is compared with English coal, which has as high as 85 per cent. of fixed carbon, one good reason why those engines steam economically on a small heating surface presents itself, although railroads abroad are much like our own in respect of avoiding high priced fuel, but there is no doubt that they use coal of a much higher quality than is the case here. Results of working tests on different foreign roads have shown an average evaporation of from 7.5 to 8.5 pounds of water per pound of ordinary bituminous coal; it is possible that while there is coal to be had high in carbon, that it is not in universal use, just

as it is understood that our best bituminous coal having 78 per cent. of fixed carbon is rarely used in our locomotives; but in any event, the average foreign coal is no doubt superior to what is known as good coal in this country.

Particulars of the actual every day performance of some well known foreign engines are given herewith for the purpose of making clear the fact that their claim of efficiency for small heating surfaces is not without some foundation, when compared with some of our machines with liberal heating surfaces. The Great Northern of England "single" is selected as one of these for the reason that it represents proportions that would not be considered in this country, yet it has a record for good work and is called economical in fuel consumption. This engine is one of the machines made popular by the late Patrick Stirling. They have 19 1-2 by 28-inch cylinders and one pair of driving wheels 96 inches in diameter, with an adhesive weight of 40,300 pounds and a tractive effort of 14,600 pounds, which shows a badly over-cylindered engine. The total heating surface is only 1,032 square feet, and the grate area 20 square feet. With these proportions the "single" takes 200 tons of train at speeds of more than 50 miles an hour, which, assuming a train resistance equal to that on our roads—as train resistance is shown by Aspinall in recent exhaustive tests on an English road to be practically the same as ours, based on Wellington's formula of quarter velocity plus two—requires an average tractive effort of 4,833 pounds, on a level, and this with the above tonnage means the development of 644 horse power. If a horse power can be furnished on 23 pounds of water per hour, an evaporation of 14.35 pounds of water per hour will be necessary from each square foot of heating surface, and a coal consumption of only 92 pounds will be required for each each square foot of grate per hour. This is a high evaporation per unit of heating surface area, but the consumption of coal is well within the limit.

The second engine is one of the Dunalastair class, on the Caledonian Railway, an eight-wheeled engine having 19x26-inch cylinders and four 78-inch drives, with 80,000 pounds adhesive weight. These engines, designed by Mr. John F. McIntosh, one of the eminent motive power officers of Great Britain, can exert a drawbar pull of 20,450 pounds, which is seen to give a ratio of cylinder power to adhesive weight more nearly in line with what we know as correct practice, but still under what the best well designed American engine has for the same service. The total heating surface is 1,600 square feet, while the grate surface is 23 square feet. A marked increase in boiler power is found here over the Great Northern engine, as would be expected in a machine designed five years later, or in 1900, although it should be stated that the Stirling engine does not represent a truly modern machine, as little change is seen in that type in the long years since they were first brought out. This Caledonian engine hauls 300 tons of train over "banks" of no mean rise, at the rate of 60 miles an hour. Measuring the work done on the same basis as for the "single"—that is, on an assumed level, and with our resistance in pounds per ton—we find an average tractive effort put forth of 7,816 lbs., and a horse power of 1,250. At 23 lbs. of water per horse power hour there is an evaporation demanded of 17.9 lbs. of water per square foot of heating surface per hour, and 166 lbs. of coal per square foot of grate per hour. Here again is a boiler power away outside of American results; and while the figures appear high they would be still higher if account was taken of grade resistance.

The record recently made on the Northern Railway of France by a De Glehn four cylinder balanced compound engine of our "Atlantic" type is of such an exceptional character as to be entitled to mention in this connection. This engine handles 175 tons of passenger train cars at an average speed of 74.6 miles an hour, and that on grades of over 0.5 per cent. The high pressure cylinders are 13 3-4 inches diameter, while the low pressure cylinders are 21 1-2 inches, with a stroke of 25 1-4 inches. The four drivers are 80 inches diameter, and the total heating surface is 2,275 square feet. Putting the resistance again at our figures, this engine exerts on the above grade a tractive effort of 9,558 lbs. and develops 1,900 horse power. If it is assumed that these compound cylinders can do this work on a water rate 18 lbs. per horse power hour, the boiler evaporates 15 lbs. of water per square foot of heating surface per hour and consumes not less than 145 lbs. of coal per sq. ft. of grate per hour. These evaporative valves are remarkable for a comparatively small boiler, and serve to illustrate what is done with small heating surfaces on the other side of the ocean. How much of this result is due to the valve gear is unknown here at this time, as the valve motion of the De Glehn engine is of a new design, there being one for each set of cylinders, which is equivalent to an independent cut-off mechanism. In comparison with the foregoing examples of foreign engine performance, that recently made on the Michigan Central stands as the best record for tonnage and speed in America. This engine is also of the "Atlantic" type, having a four wheeled engine truck, four drivers and a two wheeled trailing truck. The cylinders are 21x26 inches, and drivers 79 inches diameter, with an adhesive weight of 95,000 lbs., which may be increased to 107,000 lbs. by means of a traction increasing device operated by air, where necessary to utilize full cylinder power. The total heating surface is 3,505 square feet, and grate area is 50 square feet. This engine hauled 605.57 tons of passenger train cars on a road remarkable for its lack of grades and curves, at an average speed of 55.8 miles an hour, covering a running time of two hours and seven minutes. With the same resistance as before, there was a tractive force of 12,600 lbs. exerted to keep the train up to speed, which equals 1,915 horse power. With a water consumption of 26 lbs. per horse power hour, which is average American practice for simple engines, there was 14.2 lbs. of water evaporated per square foot of heating surface per hour, and a coal consumption of 142 lbs. per square foot of grate, in which 7 lbs. of water is taken as the evaporative value of one pound of coal. This comparison is made to illustrate how, when such an immense horse power is developed, the rate of combustion falls when the heating surface and grate area are designed to give an unlimited reserve of boiler power with coal of a low califoric value. It also shows that the small foreign boilers give a higher efficiency than is known in the average American boiler, for those under discussion all evaporated more than 14 lbs. of water per square foot of heating surface per hour; that figure being understood to represent about the limit of evaporation per square foot in America. It would appear that the favorable performance of the foreign machine could be traced to the boiler with its restricted heating surface as well as to cylinder efficiency, and it may be possible that what we are pleased to term heating surface in our multitude of long flues is not what we give it credit for.

Purifying Feed Water.

The index of the proceedings of the American Railway Master Mechanics' Association, compiled two years ago, has nearly four pages devoted to indicating where there are reports, discussions and papers relating to feed water. The declared objects of the association being "the advancement of knowledge concerning the principles of construction, repair and service of the rolling stock of railroads," the members very soon found out that the investigation of boiler feed water, was one of the most important subjects that could engage their attention, and they labored hard at it for many years. It would be difficult to estimate the amount of good that resulted from the knowledge respecting water impurities that the reports, papers and discussions circulated. That valuable educational work was performed is undoubted, and it has now led

to the use of appliances and methods that rob bad water of all its destructive power.

When the Master Mechanics' Association first began to investigate feed water impurities for the purpose of discovering remedies, hopeless darkness prevailed intensified by a pall of ignorance that no available light could break through. A practice arose of sending specimens of feed water to scientific institutions for the purpose of being analyzed. This work was duly performed and a report made of the quantity and nature of the impurities, but very little effort was made to apply a remedy. Later on when people began to apply chemicals that had a softening tendency, the same ingredients were generally employed for the treatment of all kinds of water, and of course failure resulted. Where the chemicals happened to be of the proper kind to neutralize the scale forming elements, the treatment would be followed for a short time, then neglect would intervene and finally the good work would be abandoned altogether. That was for a long time the history of attempts to purify feed water for locomotive boilers. Novelties such as zinc, potatoes and mechanical purifiers that had their day and even season of popularity, received patronage, but they were soon abandoned.

There is always considerable leakage that causes the operating expenses of railroads to be higher than they ought to be, and we think unnecessary expenses incurred by the pernicious effects of bad feed water are among the worst to be found. There are now in operation some good methods of purifying feed water that leave little to be improved, but really the best method is an efficient preventative rather than an efficient cure. Some railroad companies are compelled to wrestle with bad feed water, because nothing but bad is to be found in the territories they traverse, but there are others that suffer from bad feed water because no care has been exercised in selecting the water stations. The practice may be changing now, but in the past the officials in charge of railroad construction have followed the practice of locating the water tanks a certain distance apart without the least consideration about the character of the water obtained. In many cases by a little investigation and the exercise of good judgment surface water or water from soft streams could be obtained. Instead of that a deep-well is dug through limestone and magnesia rocks which supply water that keeps the boilers loaded with incrustations that prematurely destroy the heating surfaces and wastes fuel. If railroad managers would investigate how bad water has come to be one of their burdens they would have serious charges standing against the construction engineers.

The first railroad company to apply proper remedies to bad feed water was the Chicago, Milwaukee & St. Paul. They took hold of the business in a systematic and scientific manner. They found out the characteristics of the water at all the supply stations, had a competent chemist arrange the proper reagents to remove the impurities, and employed agents to see that the remedies were applied and the percipitated sediment removed from the boilers.

Even with the clearly defined arrangements made for treating the feed water successfully, strong persistence had to be exerted by the officials to prevent those attending the water manipulation from relaxing their efforts. Mr. J. N. Barr, superintendent of motive, speaking at one of the M. M. conventions, on treating water, said: "We all agree that this is an important matter, and we all have the idea that certain materials can be used in boilers to advantage with bad water, while ten or fifteen years ago we were all agreed that the thing was no good. I am glad to see the change. While all the methods recommended are good, it will require considerable discussion and calibrating to prove which is the best, but none of them are good unless followed out properly, and if the necessary attention is not given to cleaning the boilers."

"None of them are good unless followed out properly" is a good text to start the discussion of almost any subject connected with railroad operating. Almost any kind of bad feed water can be made suitable for boilers if the methods of treating it are properly followed out. At a discussion heard at a meeting of railroad men recently the representatives of several railroads that traverse lime rock regions asserted that the purifying of their feed water had almost entirely stopped the trouble from leaky flues and fire-boxes. The purifying had been done by companies making a specialty of treating feed water, and it evidently was well done. It is an old story which tells that it pays railroad companies to hire the work done that requires specialists.

Petroleum Oil vs. Coal as Fuel.

The past year's series of accidents and destructive wrecks on railroads throughout this country has suggested a comparison of coal and crude petroleum oil as fuel for locomotives. There seems to have grown up a feeling against crude petroleum as a fuel for locomotives, and it is believed by some persons that in such accidents or wrecks petroleum fuel may cause more serious results than would coal.

An investigation of crude petroleum as a fuel does not seem to prove this to be true. In the far West, on the Pacific slope, where, after careful experiment and consideration, crude petroleum has been so generally adopted as fuel for locomotives, accidents to locomotives so equipped, have occurred, yet it appears that the results, due to conflagration taking place, are not as serious as in other instances in the East where terrible holocausts have occurred from the igniting of the wreckage by the scattering of the hot coals in the firebox of the locomotive.

With coal as a locomotive fuel there ever exists the fact that on the train there is an incandescent mass of fiercely heated coals in the firebox, which, upon being scattered, will set fire to the débris of the wreck, burning everything, including the unfortunate passengers or persons imprisoned in the wreckage. With crude petroleum as a locomotive fuel the flames in the firebox may be instantly extinguished and no bad results will follow. This is particularly true if the locomotive be equipped with an automatic shutting-off device to stop the flow of the crude petroleum at the dangerous moment. In the absence of such an automatic device, and should the oil carrying tank be wrecked, the crude petroleum may be scattered over the wreckage. But this fact does not suggest positive or immediate danger, as does hot, burning coals, for crude petroleum itself is not an explosive nor a highly inflammable liquid. If a quantity of crude petroleum be poured upon a blazing torch the petroleum will act the same as water and extinguish the flame. If a blazing torch be immersed in a vessel of crude petroleum, the flame will likewise be extinguished, the same as if the vessel contained water. Of course, if crude petroleum be scattered over a wreckage immediately following the moment of collision impact, it remains there to catch fire and hasten the conflagration. In order to use crude petroleum as a fuel it is necessary, as our readers know, to vaporize it and combine it with other gases supplied by steam or compressed air to procure the highest efficiency. Crude petroleum oil is an efficient fuel when vaporized, but to vaporize it in the open air is an exceedingly difficult, if not impossible, operation to perform, it being possible only to vaporize, when in such conditions as exist in the firebox when the engine is in operative condition.

The superior advantages of petroleum fuel over coal fuel is that about 25 per cent. more heat units can be extracted from petroleum than from coal. There are no sparks, no smoke, no cleaning of fires, no removal of ashes nor loading of coal. These items are very considerable in the maintenance and operation of this end of the fuel account.

and it has been conservatively judged that about 50 per cent. of the cost of the fuel account will go to these items. Again, the engine is always ready for service, which is not the case if a coal fire must be started before steam can be gotten up.

With these enumerated advantages we can add the fact that a petroleum fire in a locomotive can be ignited almost instantly, and such cannot be said of a coal fire. This would seem to argue very greatly in favor of crude petroleum oil as a fuel over either bituminous or anthracite coal.

QUESTIONS ANSWERED.

(19) A. M. I. writes:

(1) What is meant by "clearance," which I notice often mentioned in writings about locomotives and other engines? A.—Clearance is a general term, but in steam engine phraseology it refers to the distance between the piston and the cylinder heads. In calculations concerning the efficiency of an engine, clearance is considered to be the space between the piston at the end of the stroke and the valve covering the admission port. That of course includes the portion of the cylinder not filled with the piston and the volume of the steam passage. (2) What is the difference, if any, between cylinder back pressure and cylinder compression? A.—Back pressure is the pressure of air or steam resisting the return of the piston from the time the latter begins to return; compression is the resistance caused by the steam or air remaining in the cylinder being squeezed into small volume after the valve closes prior to the beginning of a new stroke. A little study of any good treatise on the steam engine indicator (Hemenway, for instance) would make this question clear.

(20) Rustic writes:

I do a jobbing machine business and I find that the expense for files counts up. I have heard something about a method of sharpening files with acid. Can you give me particulars? A.—Acid sharpening of files is very unsatisfactory, but it may help out in an emergency. Clean the file thoroughly, then dip in a mixture eight parts water, three parts sulphuric acid, and one part nitric acid. After a few minutes wash the file, dry and then oil.

(21) Apprentice asks:

What is the difference between physics and natural philosophy? A.—None. They are the same thing. Natural philosophy may be regarded as the old name for the science which treats of the properties and laws of matter. The Greek investigator Pythagoras was the first to use the word "philosophy." From him it was borrowed by Socrates, who called himself a philosopher, or lover of wisdom, when other scholars of his day called themselves "sophists," or wise men.

(22) Fireman writes:

We hear so much said and written about the saving that could be effected by skilful firing that I and many others would like to get an idea of how much the locomotive fuel bills amount to in the total expenses of railroad operating. A.—About 15 per cent.

(23) A. J. W. writes:

Would you kindly answer the following questions in your April number of RAILWAY AND LOCOMOTIVE ENGINEERING? What are the qualifications and requirements of a young man who wishes to apply for the position of "special apprentice," which is in vogue on some of the large railroads? Is it absolutely necessary that the young man be a technical graduate? A.—Yes.

(24) F. B. H., Philadelphia, asks:

How does it come about that the material used on a railroad to keep the ties in place is called ballast. Is not that a nautical term? A.—Yes, it is, and the word ballast came to be applied to the broken stone or dry gravel which is laid on the permanent way of railroads from the practice of using the gravel-ballast emptied by ships when in the river Tyne. This "ballast" was first used on the various tramways in the vicinity of Newcastle, England.

(25) Subscriber, Dennistown, O, asks: asks:

Why does an engine pound harder on the forward center than the back one? A.—We do not think it pounds appreciably harder on one center than it does on the other. The only thing which might make a difference is that the area of the piston rod is taken out of the area of the piston in one case and not in another, but if this fact makes any difference it might cause a slightly harder pound on the forward center than on the back center. If the pound clearly appears to be as stated, some other defect probably exists which may deaden the noise of one knock and so make them sound unequal.

(26) A. A. P., Minneapolis, asks:

Does the crosshead move in the guides? I claim that the crosshead moves and my friend claims it does not. Which is right? A.—You are right. The crosshead moves in the guides. Your friend of course knows that the crosshead reaches first one end of the guides and then the other, but we suspect he is thinking of the relative motion of crosshead with regard to the earth. Some people think that on the back stroke the crosshead remains over one particular spot of earth during the half-revolution of the wheel, and that it is the engine which goes forward. The backward movement of the crosshead is two feet, and with a 5-foot wheel the engine, carrying guides, crosshead, etc., has moved forward more than 7¾ feet in the same time.

(27) M. A. P. asks:

How do you calculate the horse power of a locomotive. A.—The formula generally used is $\frac{PLAN}{33000}$ = horse power. Where P is the mean effective pressure in pounds per square inch on the piston during one stroke; L is the length of the stroke in feet; A is the area of the piston in inches, and N is the number of strokes per minute. This formula gives the horse power for one cylinder, and multiplying by two gives the horse power for a locomotive which is really two engines combined.

(28) T. W. A. asks:

What is the usual way of super-heating steam in a locomotive and what good does it do, and what are the disadvantages, if any? A.—Superheaters are generally made by placing in the smoke box a coil of pipe through which steam going to the steam-chests must pass. While circulating through this coil the steam is heated by the waste gases, and is delivered to the cylinders at a very high temperature. The advantage claimed is that this very hot steam gives greater range of expansion in the cylinders with less loss due to condensation. The objections are, of course, first cost, cost of maintenance and the difficulty of properly lubricating cylinders and valves constantly kept at very high temperatures.

The stockholders of the London & Northwestern Railway are reported to be agitating for reform in the operating department, and the first battle for reform was fought in the board room lately. The directors naturally think that their policy and management is as nearly perfect as possible, and they successfully opposed any change. We are inclined to think that change will come soon. We have repeatedly met a prominent stockholder of the road, who has been unalterably opposed to Mr. Webb's management of the mechanical department. That gentleman insists that the compound locomotives will be changed to simple engines as soon as Mr. Webb's influence is removed.

Five mogul locomotives have just been shipped by the Baldwin Locomotive Works for use on the Hokkaido Government Railway of Japan, two consolidation engines for the Hokkaido Coal Mining and Railway Company, and one eighteen-wheel engine for the Sany Railroad, Japan. Narrow gauge mogul locomotives have been ordered for shipment to Honolulu and Cuba.

Air-Brake Department.

CONDUCTED BY F. M. NELLIS.

The Air-Brake Convention.

Members attending the Tenth Annual Convention of the Air-Brake Association at Colorado Springs, April 28, should know and follow these points:

1. Convention headquarters will be at the Alamo Hotel.

2. Requests for transportation should be made to the master mechanic, superintendent or other immediate official. Make request early.

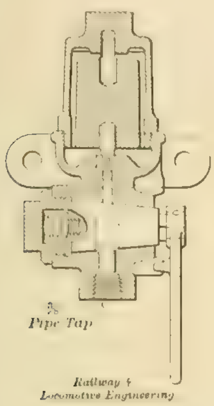


FIG. 1.

3. Take receipts for fares paid in Pullman cars. These, accompanied by membership card for 1903, will entitle the bearer to free return Pullman transportation, which will be issued by the company's agent at the convention headquarters, Wednesday, April 29.

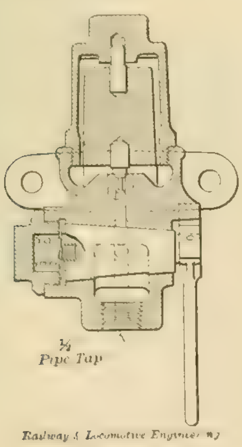


FIG. 2.

4. The hour for topical discussion will be strictly adhered to at this convention. Members having a subject for discussion must have it typewritten and in the secretary's hands at the opening hour of each day's convention. Any member having a subject which he believes would be of interest to the convention may present it under the head of topical subjects.

5. Convention will be called to order in the convention hall of the hotel at 9 A. M. sharp, Tuesday, April 28.

Speed of Air Pumps.

A correspondent writes us, asking whether the most economical speed of the pump is at a slow or high speed. This is a question which cannot be answered unconditionally or unqualifiedly.

It was believed at one time that the faster a pump was run the greater would be the pressure accumulated. This is true in point of time only, where the increase in accumulation of pressure is due to the greater number of strokes; although it is safe to say that the pressure accumulated per stroke would be less with the high speed than with the low speed, due to the fact that there would be a loss of pressure in the former case on account of the greater heating of the air and the inability of incoming pressure to the cylinder to keep up to atmospheric pressure.

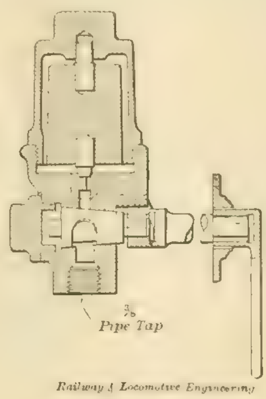


FIG. 3.

There was a series of tests made by the Air-Brake Association at one time for the purpose of determining which was the most economical speed to run a pump. These tests proved that at very high speeds the pump would heat abnormally and the incoming pressure reached considerably below the atmospheric line long before the piston had reached the end of its stroke. It seems, therefore, that no hard and fast rule can be laid down for the speed of a pump; but it is safe to say that less satisfactory work will be obtained from a pump run at top speed than one run at about 50 or 60 double strokes per minute, a double stroke being one up and one down.

Some New Retaining Valves.

The gradually changing conditions under which the retaining valve is operated has led to the manufacture by the Westinghouse Air-Brake Co. of two new retaining valves; one being for service on 12, 14 and 16-inch car cylinders, and the other, a special driver brake retaining valve, for use on driver brake cylinders exclusively. In addition to these two new valves the manufacturers are prepared to supply the old standard pressure retaining valve, which is now recommended for use with 6, 8 and 10-inch car cylinders only, and the new valve for 12, 14 and 16-inch car cylinders, with an extended socket piece and handle, so designed that the valve itself can be located outside the car hood on vestibuled cars and operated from within. By this arrangement the noise of the escaping air is avoided without affecting the accessibility of the valve.

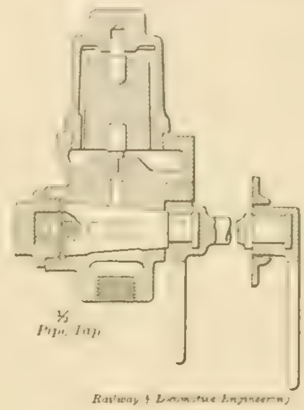


FIG. 4.

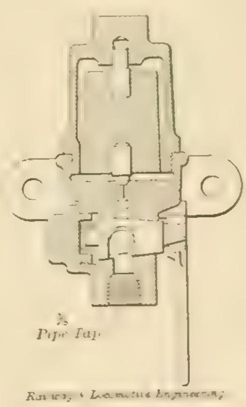


FIG. 5.

Fig. 1 is the old standard valve for use on freight cars and on passenger cars, having 6, 8 or 10-inch cylinders.

Fig. 2 illustrates a valve which has larger ports and a one-half-inch pipe,

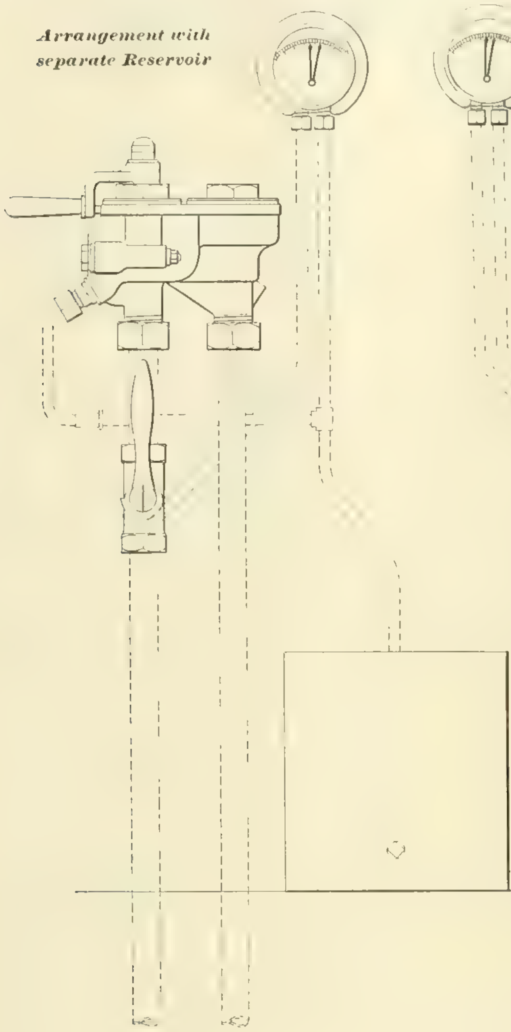


FIG. 1.

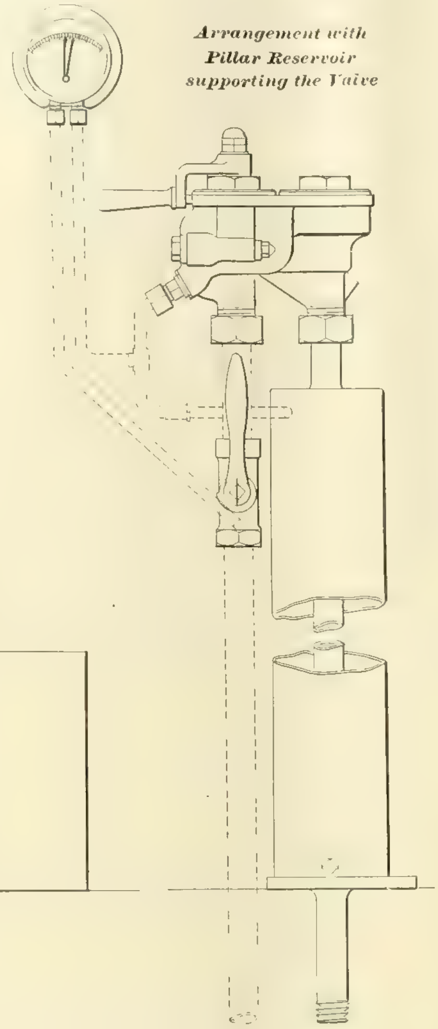


FIG. 2.

and is for use on 12, 14 and 16-inch car cylinders.

Fig. 3 is the same valve shown in Fig. 1, modified only in respect to the extension handle and socket piece, as above explained.

Fig. 4 is the same valve illustrated in Fig. 2, differing only by having the extension handle and socket piece for vestibule location.

Fig. 5 represents a pressure-retaining valve especially designed for use on an engine in connection with the driver brake. The operating handle of this valve has three instead of two positions. As in the older form, one position allows a free exhaust when brakes are released, while another retains 15 pounds pressure in the brake cylinder and causes the air that escapes after lifting the weighted valve to pass through a restricted port. The third, or lap position—the handle being at right angles to the valve stem—confines all the air in the brake cylinders and enables the engineer to release all the brakes in a train of any length, and at any speed, without unpleasant surging or danger of parting.

Altogether there are five different retaining valves manufactured by the W. A. B. Co., each weighted valve being designed to retain 15 pounds in the brake cylinder.

Some English Air-Brake Designs.

It is always interesting to note how somebody else does the same things we do ourselves, especially when their ways are quite different from ours. The accompanying drawings show how the English Westinghouse Air-Brake Co. in London assemble the parts of their several devices.

Figs. 1 and 2 are views of the different arrangement of the equalizing reservoirs for the brake valve.

Fig. 3 shows a cut of their quick-action triple valve, which is essentially the same as our American design, with the exception of the three-way cock in the lower part of the triple and whose positions are, quick action, automatic, plain automatic and cut out.

Fig. 4 shows this triple valve in place on a freight auxiliary. As will be noted, there is no cut-out cock in the crossover pipe, the three-way cock in the lower portion of the triple performing this function. The bleeder, instead of being in the bottom of the auxiliary, as in America, is located neatly and out of harm's way in the end portion of the reservoir.

Fig. 5 is a sectional view of the engineer's brake valve, with the rotary valve portion and the equalizing piston part designed side by side, instead of the former above the latter, as is the practice here.

All of the parts carry the English neatness of design with them. However, from our viewpoint, there are some old ideas which might be dropped and new ones taken up. For example: the three-way cock in the quick-action triple was abandoned in America fifteen years ago; and our English friends do not seem to have yet caught up with the slide-valve feed valve attachment for brake valves.

CORRESPONDENCE.

Excess Pressure and Main Reservoir Capacity.

The question of releasing the brake on long freight trains at low speed, without shock which will cause damage to the draft-gear, is becoming very important. The shock is due, principally, as is well known, to the difference in the time of release of the brakes, that is, could all the brakes be released at the same instant, no shock of any consequence would occur. Should the slack of the train be stretched out when an application is made, the same as it is when the locomotive is drawing a train, then the difference in the time of re-

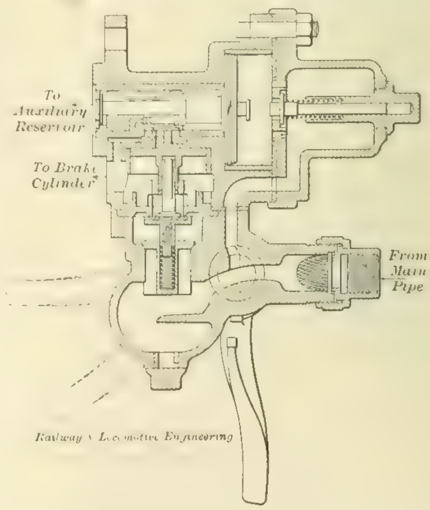


FIG. 3.

lease would not cause a shock. The slack, however, when an application is made, generally bunches toward the engine, the same as it is when the engine is backing the train; then, with brakes releasing earlier on the head end

than on the rear, the slack is due to the reaction of the draw bar springs, which were compressed more or less, due to the slack bunching, runs out quickly until it is suddenly arrested by those cars at the rear on which the brakes have not released, resulting in a shock of more or less severity, and, when the draft gear is not sufficiently strong to withstand it, the train is parted. When the break occurs near the middle, or further back, the application of the brakes on the head portion, due to the hose couplings separating, generally results in the head portion being broken in two at one or two other places, so that when the train is finally stopped, it will be separated into three or four different parts.

The severity of the first shock depends largely on the make-up of the train; the weight of the engine in particular. The greater the weight of the engine, the greater the shock. The amount of compression of the draw bar springs, at the time of release, affects the shock; also the retarding power of the rear brakes.

An illustration of this may be had by attaching one end of a cord about three feet long to a two-pound weight, and the other end to, say, a half-pound weight. The first to represent the weight of the engine, and the second the retarding effect of the brakes on the rear which have not released. Place them on a table with the leaf up, the one half-pound weight on the main part, and the other on the leaf, so that there is about a foot of slack cord, and in such a position that the large weight can be moved to take up all the slack without being moved off the leaf. Then tip the leaf just enough to cause the large weight to slide toward the floor. Now we will assume the cord is just strong enough to stand the shock and permit the larger weight to pull the smaller one along with it. Now increase the larger weight to four pounds, and repeat the experiment, and you will find that the cord will be broken. Repeat the experiment again, and this time use the same large weight, as was used in the first experiment when the cord was not broken, and increase the small weight to one pound, and you will find that the cord will now be broken. The first experiment would have resulted in the cord being broken had it not been quite so strong. Therefore, the result of brakes not releasing as early on the rear end as on the head end, depends on the bunching of the slack, weight of the head end, retarding effect of the rear brakes (which is determined by the application, braking power, and speed), and the strength of the draft gear.

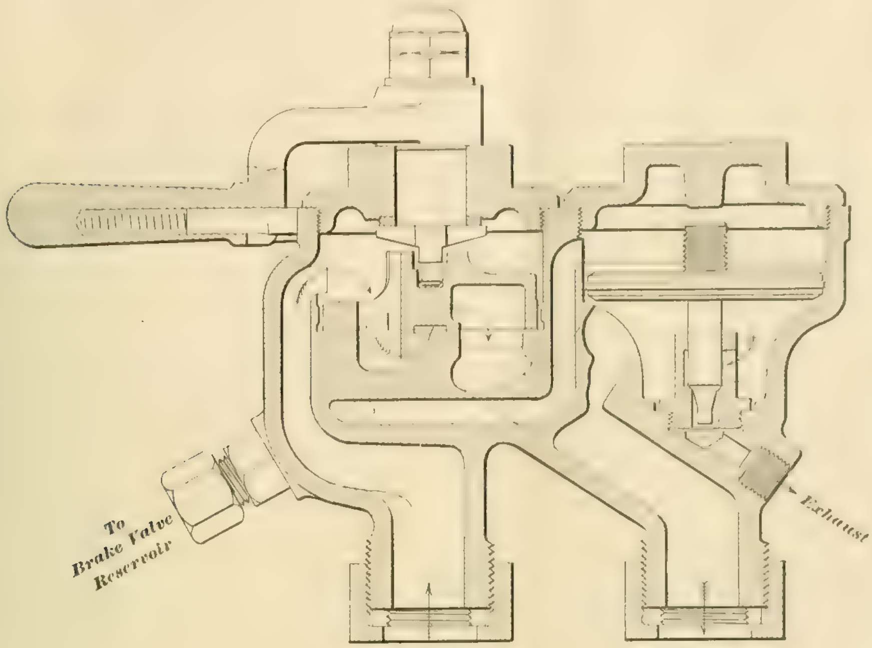


FIG. 5.

The release of brakes is accomplished by quickly increasing the train line pressure, above that of the auxiliary reservoir, and air stored in the main reservoir, or reservoirs, is depended on to accomplish this. In order for any of this air to reach the rear car it must pass through about 2,000 feet of pipe on a 50-car freight train. The frictional resistance which it meets with retards its flow, resulting in the head brakes releasing earlier than the rear ones.

Tests made by the Westinghouse Air Brake Company with a 50-car train, brakes applied by a 10-pound reduction from 70 pounds, showed that with a main reservoir capacity of 50,000 cubic inches, charged to 100 pounds pressure, the train line pressure was raised from 60 to 62 pounds, on the fiftieth car in 9.9 seconds from the time the handle of the brake valve was placed in full release position, and at this time the train line pressure on the head car was 74 pounds. With main reservoir capacity of 20,000 cubic inches charged to 125 pounds pressure, the train line pressure was raised from 60 to 62 pounds on the fiftieth car in 9.5 seconds, and at this time was 76 pounds on the head car. The main reservoir pressure in both of these tests was reduced to 86 pounds in the time given.

It appears from these tests that large main reservoir capacity is not of so much value in releasing brakes as high excess pressure in reservoirs of small capacity.

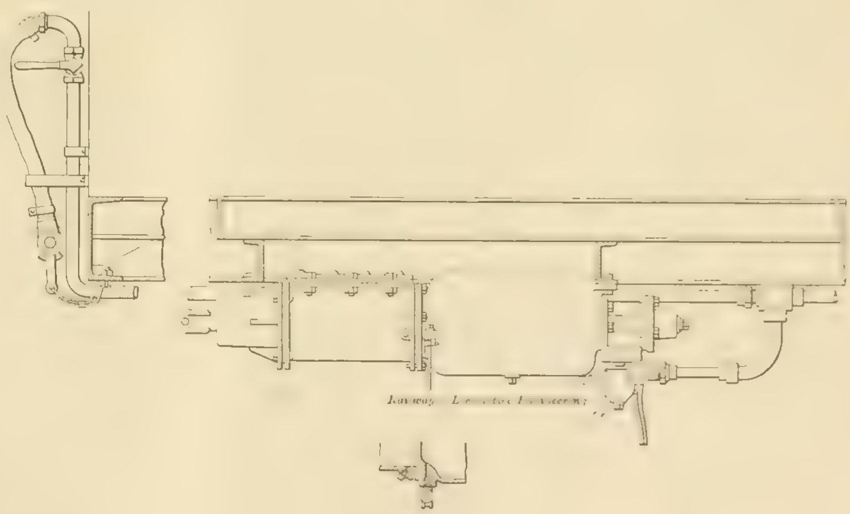


FIG. 4.

On engines with a main reservoir capacity of 20,000 cubic inches, and carrying 100 pounds pressure, better results in releasing the brakes will be obtained by increasing the main reservoir pressure 25 per cent. than by increasing their capacity 150 per cent. This, considering the room available on many engines for main reservoirs of greater capacity, is important. There are other reasons, however, which makes it advisable to have large main reservoir capacity, at

least 50,000 cubic inches on freight engines.

E. G. Desoe,
General A. B. Inspector B. & A. R. R.
Springfield, Mass.

Retaining and Recharging Device.

An air-brake device has recently been patented by N. J. Benton, a machinist in the L. & N, shops at Birmingham, Ala., and W. P. Thomas, a locomotive engineer, of Louisville, Ky. This device has been tested by one of the largest railroad companies and it is believed will be adopted by them, as it fills a long-felt want for trains on hills and switch engines. In the former case, the engineer can retain his brakes on the train while recharging the auxiliary reservoirs, independent of the assistance of trainmen. In the latter case, a switch engineer can apply and release quicker than he can with the present automatic system; but this is only to be used when in a hurry or when the automatic system is inoperative either from corrosion or leaks.

The brakes can be operated, if desired, by either the automatic or this straight air feature, independent of each other, or both can be worked at the same time. If the automatic brakes fail to work, the straight air feature can be operated, and, unless pipes are broken off, or the leather is not entirely gone, you will get sufficient power to make a short stop.

In the accompanying drawing you can see all the new features that are necessary for the aforesaid results.

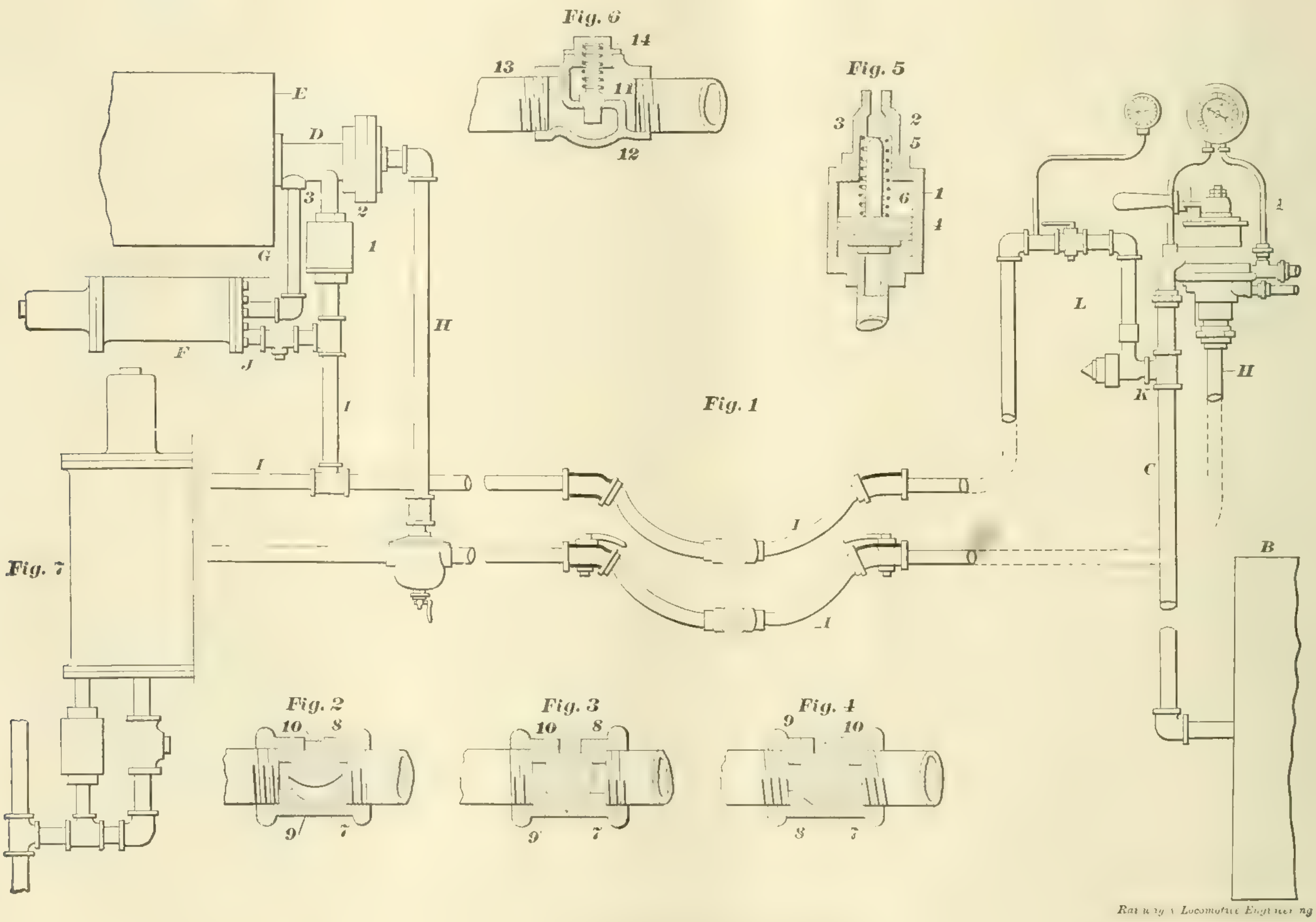
Figs. 2 and 4 in the drawing show positions of the cut-out cock for applying and releasing brakes, and is placed in the pipe running from the engineer's valve to the triple on the engine.

Fig. 5 shows the new automatic retainer used in connection with the apparatus, and it screws into the triple-valve exhaust port, so when the handle of the cut-out cock is turned in position shown in Fig. 2, the air would be admitted to the retainer, closing up the triple exhaust, raising check valve *J* (Fig. 6) off its seat, admitting air direct to brake cylinder.

When the handle is turned to the position shown in Fig 3, it is on lap, and, as shown in Fig. 4, it will allow the pressure in the pipe to escape, which relieves the retainer, causing an automatic action of same and allowing the brakes to release.

For switch engines, the device, as shown in Fig. 7, can be used without the aid of the triple, auxiliaries and brake valves, thus receiving a pressure direct from the main reservoirs, and releasing right at the brake cylinder, by the aid of the new retainer and check valve, assuring a quicker release and a more positive brake application.

W. P. Thomas,
Loco. Eng'r, L. & N. Ry.
Louisville, Ky.



RETAINING AND RECHARGING DEVICE.

QUESTIONS AND ANSWERS

On Air-Brake Subjects.

(26) B. R. O., New York city, asks: Which is the best kind of a driver brake, one which has a horizontal pull or one which pulls straight up and down? A.—A push brake is better than a pull, as the stuffing box is done away with. The brake which pushes down in a perpendicular direction is much preferable to the horizontal type, for the reason that the wear of the packing leather is even on all sides, and does not bear on the bottom merely and wears out that portion of the leather, as does the horizontal type.

(27) B. G. E., Denver, Col., asks: Is there only one automatic reducing valve for the high-speed brake, and is it used for the 10, 12, 14 and 16-inch brake cylinders? A.—There is but one type of automatic reducing valve for the high-

speed brake, but it is made in three different sizes to accommodate respectively the 8-inch cylinder, the 10 and 12-inch cylinders, and the 14 and 16-inch cylinders. This is made necessary by the great difference in the capacities of the largest and smallest cylinders, and permits of a more uniform reduction of high-speed cylinder pressure to the normal or ordinary cylinder pressure.

(28) B. R. E., Galesburg, Ill., asks:

Why shouldn't a quick action triple valve be used on tenders? Is it not the practice of some roads to put quick action triples on tenders? Is it to give higher brake power that some roads use the quick action triple on tenders? A.—The only objection to quick action triples on tenders is the tendency of hostlers to unduly use the emergency in "spotting" an engine on the turntable, etc. Some roads have been using quick action triples on tenders for some time. All tenders equipped with the high speed brake should have quick action triple valves, as this gives them the highest possible brake power in emergency. The Westinghouse Company has now adopted the quick action triple valve for all passenger engine tenders, whether they have the high speed brake or not.

(29) F. J. K., Winona, Minn., writes:

If, in making a stop with a heavy freight train, the drivers should begin to slide, and you did not dare to release the brake for fear of breaking the train in two, what would you do? Would it be advisable to open the engine throttle and get your wheels revolving? A.—It would be better to accept a chance of breaking your train in two than a sure thing of sliding flat spots in your drivers. If your driver brake was holding well enough to slide the drivers, it would also hold so tight and hold the drivers locked that opening the throttle would not jerk them loose and start them rolling again. The better thing to do would be to prevent the trouble by having the proper braking power on the drivers so they would not slide.

(30) J. L. M., Sioux City, Ia., writes:

Has anybody ever tried to make the air-brake signal work on the train pipe of the air-brake? If so, what has been their success? What objections are there to such an arrangement? A.—The principal objection to such a scheme is that it would be impossible to get a signal to the engineer while he is applying or releasing brakes. This is a serious fault. Mr. Westinghouse patented such a device nearly thirty years ago.

(31) T. G. K., Spencer, N. C., asks:

What is the best mode of grinding triple valve slide valves and what best and most convenient tool for boring out the triple bushings? A.—The best method of grinding the triple valve slide valve is to face it to its seat, either by machine or hand scraper, leaving as little grinding to do as possibte. Some good grinding material, such as ground glass or Trojan compound, should be used, which will not stick in the brass after the job is finished. Modern long train service has demonstrated that it is impossible for the railroad shop repairman to properly fit a triple piston packing ring into its bush in a triple valve, because of lack of necessary facilities. Therefore, this delicate, refined work is sent to the manufacturer by railroads nowadays, as the manufacturer is equipped with special machinery for doing this kind of work. Modern long train service makes this practice wise and advisable.

(32) W. T. G., Dayton, O., asks:

Will a 9½-inch pump make more air per stroke running at 100 strokes a minute, 150 strokes a minute or 200 strokes a minute? By stroke I mean a single stroke, either up or down, of the piston, one up and one down being counted as two strokes. A.—This would largely depend upon the size and lift of both receiving and discharge valves, the condition of the packing rings in the piston and the accuracy of the bore of the cylinder. The ideal conditions for any number of strokes per minute would be perfectly tight piston packing rings, accurately bored cylinder, receiving valves of sufficient size and lift to give full atmospheric pressure in the cylinder during the whole stroke of the piston and the discharge valve of sufficient size and lift to allow the piston to thoroughly push the pressure out of the air cylinder into the main reservoir. These conditions could be so made and manipulated in one pump to favor a slower stroke, while by another condition of the parts the reverse could be made to be true. However, the results at a series of tests held by a committee appointed by the Air Brake Association proved that an air pump driven at top speed would pump less air than one run about 120 single strokes per minute.

(33) J. B. O'D., Freeland, Pa., writes:

I am interested in retaining valves and would like to know if the following device would be any value in the railroad world. The device gives the engineer full control of the retainers after the train crew turns them up. He can release part or all of the air from the retainer pipe, holding on as many of them as will hold the weight of the engine and prevent the train from parting. A 30-pound retaining valve can be used with this device on account of having full control of the retainers at all times. It is simple and inexpensive, and is operated with the train line pipe and engineer's brake valve. It doesn't interfere with the working of the triple valve. A.—It might be interesting. Send us a sketch and description and we will see. Usually, such devices haven't much money value.

(34) G. E. C., Moncton, N. B., Canada, writes:

A 9-car passenger train broke the train pipe on the baggage car next to engine. The crew coupled the train pipe on engine to signal pipe on this car, and used it as a train pipe to connect to the rest of the train. At the next point where engines were changed, the car inspector had the baggage car placed on the rear end of train. This action is condemned by some. Will you please give your opinion as to the propriety of the use of signal line under such circumstances? A.—Both the practices indulged in with this train were in accordance with good practice. In the first place, when the train pipe on the first car was discovered to be defective, the train line of the tender was quickly coupled (by means of a special coupling, no doubt,) to the signal line on the front end of the first car. The signal line at the rear end of the car was coupled again to the train line of the second car. This got around the difficulty with the least possible delay. In the second place, when a terminal was reached where time was found to shift the defective car to the rear end, it was done so by the inspector, who doubtless coupled up the air brake hose on the car ahead to this defective car, keeping the angle cock closed on the forward end of the last, defective car. This also was good practice, for it permitted of quick action application of the brakes through the entire train, which could not have been had if the signal line had been used on the car next the engine. It also brought safety to the rear car in case it should brake off, by the coupling up of the air brake hose, whose separation would set the brakes on the entire train if the rear car broke off.

(35) A. M. L., New York city, writes:

We have the Westinghouse Air-Brake on the Manhattan elevated. When I put the handle of the brake valve to the first notch in service position with a six-car train, the brakes won't act, and I have to go past that notch to get the brakes on. But with one-car train, if I put the handle to the first service notch I get quick action. What is the matter? A.—Disregard the notch. Don't go quite so far as to apply brakes on single-car train, and go further with six cars.

We regret, exceedingly, our failure to issue the first of the color charts of the Desoe series in our last number, as intended; but accuracy of detail must be considered ahead of all features, and this month will see the belated chart in perfect condition.

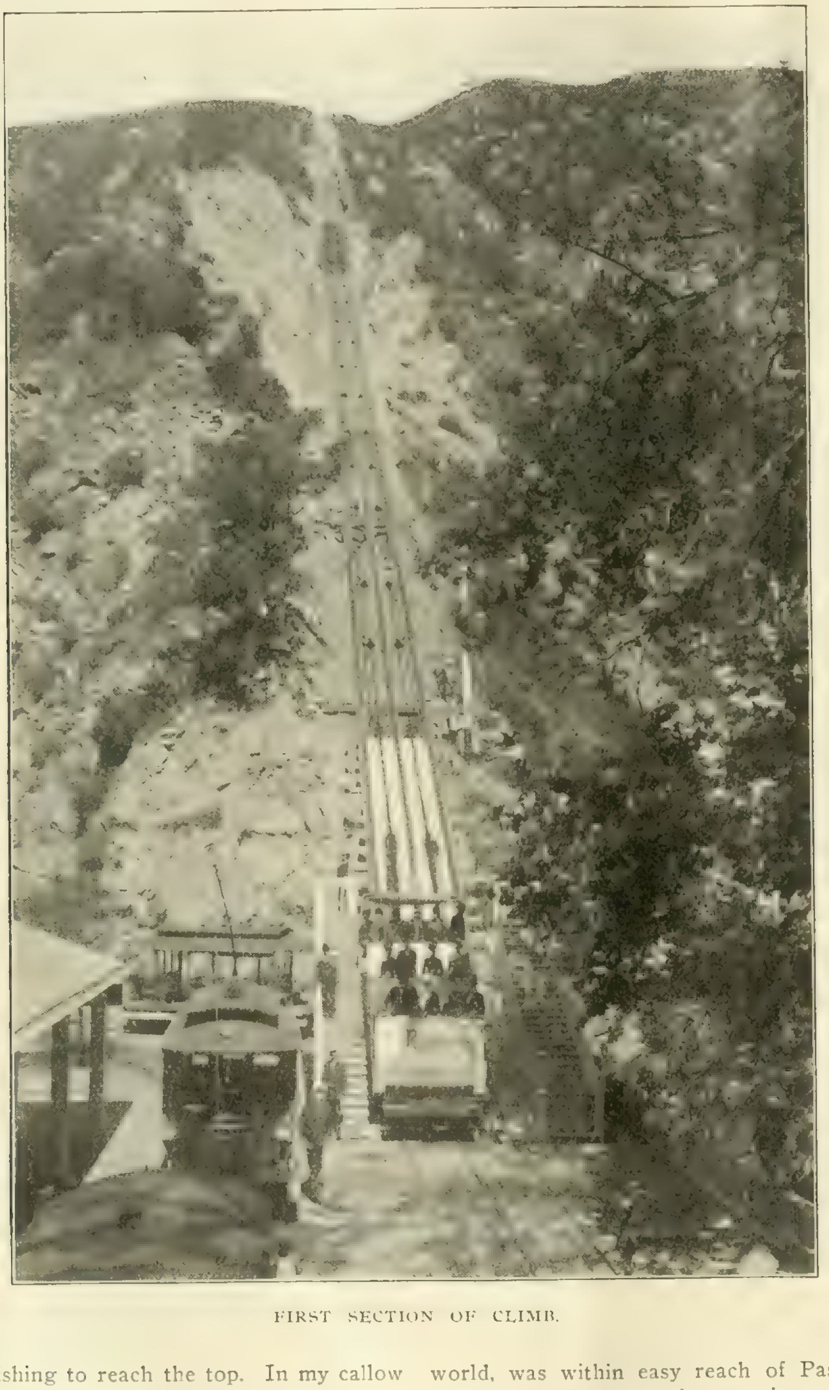
Ascent of Mount Lowe.

BY ANGUS SINCLAIR.

PASADENA, Cal., March 11.

There is a curious fascination in mountain climbing to some people, and I must confess myself a little touched with the mountain climbing fever. I seldom look upon a hill or mountain aspiring away above the surrounding country without wishing to reach the top. In my callow years that tendency frequently led to long, exhausting climbs that left the tor ture of strained muscles for days afterwards and paid by pain for the pleasure enjoyed.

Age has not cured the mountain climbing aspirations, but now-a-days I like to make the ascents in a comfortable car or at least on something where a medium more tireless than human muscle provides the elevating power. I have done some mountain ascents in Switzerland and other places, in railway cars, and they suited my taste, which leans rather toward comfort than toward physical triumphs. When I heard that the Mount Lowe Railway, one of the most celebrated scenic mountain railways in the world, was within easy reach of Pasadena, where I was staying, no time was lost in making the ascent.



FIRST SECTION OF CLIMB.

Mount Lowe belongs to the Sierra Madre range of mountains, which with a lesser range to the south, form the barriers of the San Gabriel Valley. They speak of other valleys within the natural borders named, but it is really one great valley, in which are found the finest fruit-raising orchards of California. The Santa Fé Railway traverses the valley and forms the chief means of communication with the outside world.

Pasadena is in the Southern part of this valley, about ten miles from Los Angeles. It is situated on a sloping plateau about 800 feet above Los Angeles, and is a town of about 10,000 inhabitants, it is the prettiest place I have ever seen. Handsome houses, with all the attractive surroundings that tropical trees, profusion of flowers and beautifully kept lawns can supply. The streets are finely maintained, cultivated taste dominates the whole town, and all signs of filth, penury or sloth's defilement are absent. It is a dwelling town of wealth of the kind that carries with it refinement and cultivated taste.

Viewed from the hotel, the Sierra Madre Mountains appears to be about a mile away. Such is the deception of this transparent atmosphere, that on boarding the street car we find that a journey of about five miles must be accomplished before we reach the base of the mountain where the first stage of the scenic railway begins. Speaking of mountains Campbell says:

"*Distance lends enchantment to the view*
And bathes the mountains in an azure hue."

That description does not apply well to the Sierra Madre Mountains. At a distance their rugged outlines are rounded off, but the visitor must be amidst the rugged defiles and profound charms, to witness the rich variety of color and the softened aspect imparted by the profuse vegetable undergrowth and the towering pines and larches and live oaks that stand up like mere stately bushes in the deep recesses of the Canons.

The first section of the ascent is by a substantially built double track cable road. The starting point is called Rubio Pavilion, from whence the road rises on a grade of about 60 per cent. average to Echo Mountain, a vertical distance of 1,325 feet. That is an uneventful trip, little more exciting than going up a skyscraper elevator, but it introduces the tourist to a trip which strains the nerves of all but veteran mountain climbers.

The ascent which follows is made by a single-track trolley railway which is five miles long and has an average grade of 7 1-2 per cent. The route is round a succession of jutting crags, everywhere hugging, yawning precipices and spanning chasms that are thousands of feet deep. But the imposing grandeur of the scenes is sublime. The beautiful valley below looks like a checker board of what we know to be the richest orchards in the world, and away beyond another range of hills shine the blue waters of the Pacific Ocean. We witness scenes so impressive that they will always cling to the memory, but the engineer who understands the possible defects of car

building material would rather view the scenes from a car that had something more reliable than friction brakes to hold it in descending a 7 1-2 per cent. grade on a 4 ft. gauge.

On getting to the end of the track I discovered that the railway stopped 1,100 vertical feet short of the summit. As I had started to go to the top of Mount Lowe, and go there I must, if the remainder should be walked. An easier means was at hand, and the party finished the trip on steeds.

I have spoken of the quick transition from winter to summer in making a trip by rail from New York to Florida. The ascent of Mount Lowe brought a much quicker change of temperature. In about three hours we went from the region of yellow oranges, peach blossoms and blooming flowers to a region of arctic snow and ice.

Going around a succession of sharp curves, on a car with yawning chasms beneath the track, is not a comfort-inspiring ordeal, but it is nothing to rounding similar precipices on the back of a pony following a path no wider than the animal's body. It was bad enough when the path was solid mud, but when it came to be covered with six or eight inches of snow, ice and slush, on which the animal's feet slipped every few steps, the reflection came that a little pleasure was purchased at a high price.

We had one hero in the party whose name was "Dewey." He had long ears and a shaggy grey coat, but he had sagacity, grit, perseverance and courage. Dewey regulated the pace of the cavalcade, and no difficulty or danger disturbed his equanimity. When the spirit moved him Dewey stopped and fell into profound reflection, mixed with slumber. When he elected to move he moved, but not before, and then we all felt satisfied that he had seen his way to get there without accident. Thanks to his care and to good luck we got to the summit, surveyed the world as from a higher Mount Pisgah and got down to the common level to tell the tale.

Why an Engine Slips in Backing Up.

BY J. A. B.

Tractive force we know is the power which the pistons of a locomotive are capable of exerting through the driving wheels to move engine and train. To prevent slipping of the driving wheels the adhesion must be sufficient to overcome this, which necessitates a weight to rest upon them equal to or more than four times the power exerted upon the pistons, and where the engines are intended for heavy freight service this weight is increased to 5 or 6 times the power of the pistons. Most of us have seen or run slippery engines, particularly in backing up, but I have never before seen a theory advanced as to why an engine slips readily backing up. I know that my solution will bear me out where the ratio of power to adhesion is nearly 1 to 4. As an illustration, let us take an engine with cylinders 17 in. by 24 in.; diameter of driver 57 in., weight on drivers 60,000 pounds, boiler

WINDINGS OF THE TRACK.

pressure 155 lbs., and mean pressure about 130 pounds.

This class of engine will give us a tractive force of 16,000 pounds. Allowing 10 per cent. for friction brings it down to 14,400. With the weight mentioned above on her drivers and 10,000 pounds on the engine truck, we know that when she is running forward the power transmitted from the piston to the cross-head is against the upper guide bars, with the result (from rough calculations) that we take about 5,000 pounds from the engine truck and transfer it to the drivers, as the action from the cross-head to the driver exerted through the main rod is downward toward the rail, so that we now have 65,000 pounds on the drivers in motion, while we only have the normal weight when they are at rest. Backing up we reverse the conditions. The cross-head now throws the strain on the bottom bars, which gives a downward pressure to the truck, an equal amount of upward pressure to the driving wheels and a tendency to raise the drivers from the rails. In this case we have reduced our weight on drivers to 55,000 pounds, but added 5,000 pounds more pressure on the rail at the truck.

Taking the power exerted upon the pistons in this case and allowing 10 per

cent. for friction, we have, as stated before, an effective pressure of 14,400 pounds exerted by them as available tractive force. Four times that force, or 57,600 pounds, is the amount necessary for weight on drivers, but with the engine backing up and 55,000 pounds on the drivers, we are short 2,600 pounds, and just that much nearer to the slipping point. Of course this 10 per cent. allowed for friction I have based upon favorable conditions, and cannot be held accountable for variable conditions of friction due to want of lubrication. That is up to the company that wants a big oil record. They may get the oil record, but the question of friction or the revenue the engine earns to compensate for this record is an unknown quantity. Increased friction reduces earning power.

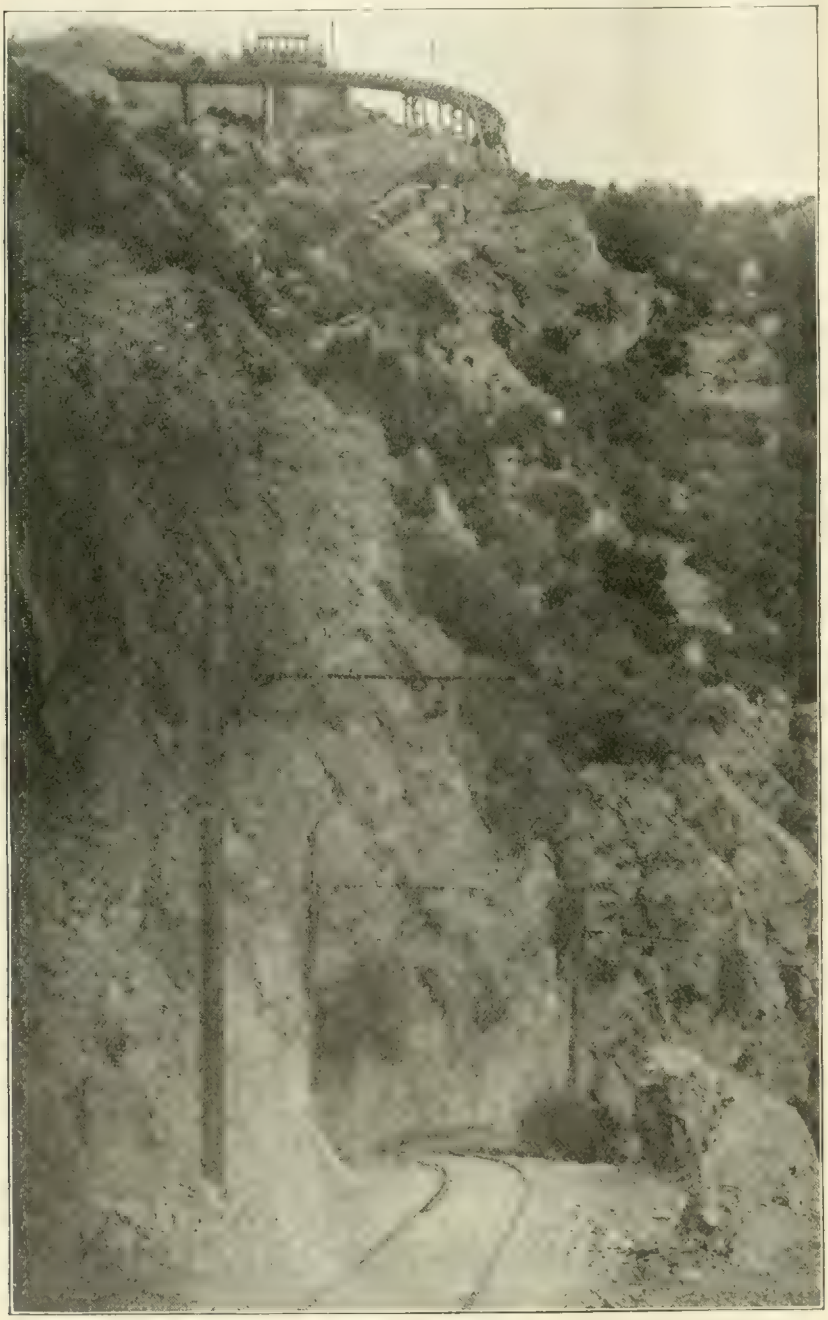
Heroes of Imagination.

The fairy tales on which many reputations rest seem to be vanishing into thin air in these matter of fact days. We have been made melancholy by the sermon of a preacher on last Washington's birthday, who alleged that the cherry tree and hatchet story was a myth gotten up by the first biographer of the Father of his Country, who was a preacher and considered poetic license fair in working up the actions of a hero.

The scoffer and the cynic would have point taken from their stings if the statements of other gushy-gushy biographers were repudiated by all sane writers. But we still find that the stale silliness of Samuel Smiles gravely tells that James Watt had his attention directed to the potential power of steam by seeing the lid of his mother's tea-kettle vibrating from the action of the boiling water. That was a pretty story, but other men made the preliminary discoveries about the force of steam which prepared the way for Watt's work on the steam engine.

All through the history of important discoveries we find men accorded romantic triumphs which rightly belonged to others, and the injustices are made popular by hero worshippers who have learned the art of scribbling without fairness or judgment.

A CAREFUL MOUNTAIN CLIMBER.



A LONG CLIMB.

Color Ignorance Not Necessarily Color Blindness.

A good many men can very readily distinguish between various colors or even between tones of color who could not correctly name the shade selected. Ignorance of the name of a color should not be confounded with color blindness, which latter is the inability to tell red from green or yellow from purple or any definite color from any other. Color ignorance may be removed by proper instruction, but color blindness is a defect of the eye. We knew of a man who was taken to task by his wife for some outrageous description of the ribbons in her hat. He was shaky about when the word "mauve" should be used, or when a delicate "ecru" would correctly describe a shade worn, but he could nevertheless pick out all the colors of the rainbow with unerring accuracy.

Tourist: When does the next train start for Cork, porter?

Irish Porter: She's just gone, sorr.—*Judge.*

Compound Oil-Burner for the Southern Pacific.

A very interesting example of an oil-burning compound consolidation engine is here presented. It has been turned out by the Baldwin Locomotive Works for the Southern Pacific. The cylinders are 17 and 28x30 in., the high pressure being underneath. The driving wheels are 57 in. diameter, and all are flanged. The two leading wheels are equalized with the front truck, and the two rear drivers are equaliezd by themselves.

The boiler is of the straight top variety and radial stayed. It is 76 in. in diameter at the smoke-box end. The heating surface is in all about 3,604 sq. ft., of which 3,390 sq. ft. are in the tubes. There are 442 tubes, and the grate area is 54½ sq. ft. The weight of engine and tender is 210,130 pounds, and 185,240 pounds rest on the drivers.

The striking feature about this machine is the tender, which is semi-circular in sections and contains 3,300 gallons of fuel oil and 7,300 gallons of water. The tender has a running board and hand rail the full length, with ladder and steps at the back. The tank is carried on a steel channel frame. The tender is longer than usual, being in the neighborhood of 24 ft., which is no doubt the result of the special design which the Southern Pacific have adopted.

Some of the principal dimensions are subjoined:

Cylinder, 17 in. and 28 x 30 in.

Valve, balanced piston.

Boiler, thickness of sheets, $\frac{25}{32}$, [illegible], and $\frac{29}{32}$; working pressure, 200 lbs.; fuel, oil; staying, radial.

Firebox, length, 108 in.; width, 72½ in.; front, 75¼ in.; back, 66¼ in.; thickness of sheets, sides, $\frac{3}{8}$ in.; back, [illegible] in.; crown, [illegible] in.; tube, $\frac{5}{8}$ in.; water space, front, 4 in. to 4½ in.; sides, 3½ in. to 6 in.; back, 3½ in. to 4½ in.

Tubes, number, 442; diameter, 2 in.; length, 14 ft. 9⅛ in.; heating surface, firebox, 182.2 sq ft.; tubes, 3,390.7 sq. ft.; firebrick tubes, 30.9 sq. ft.; total, 3,603.8 sq. ft; grate area, 54.5 sq. ft.

Driving wheels, diameter outside, 57 in.; journals, main, 10 x 12 in.; others, 9 x 12 in.; engine truck wheels, front, diameter, 30½ in.; journals, 6 x 10 in.; wheel base, driving, 15 ft. 8 in.; total engine, 24 ft. 4 in.

Weight, on driving wheels, 185,240 lbs.; on truck, front, 24,890 lbs.; total engine, 210,130 lbs.

Tank, capacity, oil, 3,300 gal.; water, 7,300 gal.

Tender, wheels, diameter, 33½ in.; journals, 5½ x 10 in.

SOUTHERN PACIFIC COMPOUND OIL BURNER

The Elizabethport Shops of the Central Railroad of New Jersey.

The shops of the Central Railroad of New Jersey, situated at Elizabethport, N. J., are good examples of modern design and equipment. The main shop is a building of red brick standing on a concrete foundation. It is 700 feet long by about 150 feet wide, and contains the erecting shop, machine shop, boiler and tank shops. One of the features which strikes a visitor on entering is the design of the building with reference to securing the greatest amount of daylight. The erecting shop is about 80 feet wide and is about 45 feet high. The south wall is well lighted with windows, and the roof is, in the centre, covered with what is called translucent fabric. This material is applied somewhat as panes of glass would be applied, and it allows diffused light to enter while it prevents the direct glare of the sun from getting in. What would be the north wall of this building is represented by a line of steel columns, and to them are attached the beams of a flat-roofed lean-to. The vertical wall above the lean-to is almost entirely glass, while the center of the roof is composed of translucent fabric. Beyond this first lean-to is a second lean-to. The vertical wall above its flat roof is glass, and the center of the roof is also covered with translucent fabric. The north wall of the second lean-to is liberally supplied with windows. Viewed from the outside this building is like two or three steps of a gigantic stairway, in which the "risers" have plenty of glass, and the "treads" or flat roofs of the lean-tos are covered largely with translucent fabric.

The erecting shop has three tracks parallel to the length of the shop, and it will hold about 35 locomotives. Two 50-ton Shaw electric cranes of 80 foot span cover the entire area. Engines when being placed or removed are carried up or down the space between the tracks, the cranes doing the necessary "side-stepping" at either end of the shop.

In what we have called the first lean-to there are two electric cranes operating, having each a span of about 35 feet. One is a 3½-ton crane for light pieces and the other is a 10-ton crane. At the west end of this lean-to the wheel and axle work is done; further down the frame and cylinder work is handled. The foreman's office occupies as nearly as possible a central position, and east of it the eccentric straps, rocker boxes, tumbling shafts, etc., are fitted up, and further on is the general repair department.

In the second or outer lean-to lighter work is done, for which the services of overhead travelers and runways are sufficient. In this building are contained the valves, pistons, guides, etc., department, driving boxes; links and rods; the tool room, the air brake department, the pipe fitting department and the machinery for doing stock work. The copper shop and flue departments are also here. The machine shop tools are operated by both individual and group drive according to the character of the work required.

The lower or east end of the main shop and both lean-tos form the boiler and tank shops, with riveting plant served with a 40-ton crane. The riveter is of the pneumatic-hydraulic type, and when not in operation the overhead crane carries a portable pneumatic-hydraulic riveter for tank work. There are three Ferguson oil furnaces in this shop and one annealing furnace of the Ferguson type.

The entire erecting, machine and boiler shop building is heated by the Buffalo Forge Company's system. A separate building containing a well appointed lavatory is provided for the men and expanded metal lockers are furnished to each individual worker.

The blacksmith shop is a building made entirely of concrete, and is about 300 ft. long by about 83 ft. wide. This shop is supplied with Sturtevant down-draft forges. There are four large jib cranes, two of which serve the large steam hammer; one is placed near a large Acme bulldozer, and one takes care of material for frog, crossing and switch work. This department is also equipped with a drill, cold saw and planer. The bolt headers, bolt cutters and nut tappers are also in

this building. There are three Ferguson oil furnaces for the bolt headers, one for the hammer and one for the bulldozer. A track is laid in the center of the shop which communicates with the storehouse and also with the main transfer table.

The power house is located in a central position, and supplies steam, compressed air and electric power to the various shops. The equipment at present consists of three Ballwood engines, two air compressors and two 500 h.p. boiler batteries. There is room for the installation of three other Ballwood engines, two additional air compressors and another battery of boilers. It is expected this plant will be one of the air compressor stations for the electro-pneumatic block signal system which is used on the C. R. R. of N. J. The feed water for the boilers is heated by exhaust steam and is pumped under pressure into the boilers at a temperature of 230 degrees F. The company's officials are contemplating installing mechanical stokers, and an ash and coal handling plant at an early date.

The paint shop is a concrete building 325x150 ft., having its long side fronting on the transfer table, which also passes along the ends of the erecting shop and the blacksmith shop. This shop is well lighted and contains a good modern stockroom with storeroom for paints, oils, varnishes, etc., in what might almost be called an air-tight cement cellar, in the construction of which nothing inflammable has been used.

Crossing the transfer table the passenger car repair shop is reached. This is also a concrete building, 425x100 ft., its long side, like that of the paint shop, extending along the transfer table. In this department the wood-working machinery is placed, though partitioned off from the rest of the shop. The pattern makers occupy a corner of the room. There are three fire walls in the paint shop and three in the passenger car repair shop. Back of this shop is a small transfer table capable of handling trucks, etc., from one track to another in the passenger car repair department, and of conveying material to the upholstery department, the cleaning and dyeing department, and the varnishing department. These three departments are in one building, 150x30 ft., made of brick, with concrete foundation, each occupying a separate room. Further on is an isolated brick and concrete building 70x30 ft., used for pattern storage.

A feature worthy of note is the oil house, which, while not yet finally completed, is expected to stand as a model for economical and prompt handling of oils for the entire road. This is a building made entirely of concrete and measures 80 ft. x 20 ft., with an outside platform 11 ft. wide. A cellar or basement 16 ft. deep extends beneath the entire structure, including the platform. In the basement are located four large tanks with about 11,000 gallons capacity each. These tanks are for oils most commonly used: kerosene, engine oil, car oil and signal oil. There are also seven smaller tanks which will contain from 400 gallons to 1,600 gallons each, for other kinds of oil. The four oils first mentioned are purchased in tank-car lots. The other kinds in barrels.

Upon the arrival of a tank in front of the platform connection is made with pipe from bottom of tank car and the oil runs by gravity from tank-car into large storage tank. In the oil room is a row of spigots (connected with storage tanks) under each of which is a sink to receive the drip. These sinks have lead pipes leading each one to its appropriate tank, so that the loss is reduced to a minimum. The sinks are also used for the purpose of filling the small storage tanks in cellar with the oils that are purchased in wood.

An air valve at each spigot controls the lifting of all oils for distributing or to fill barrels, which is done entirely by air pressure. A barrel can be filled with kerosene in about two minutes at an air pressure of about 30 pounds. Empty barrels and those filled for shipment are stored in the basement and will be raised and lowered on a pneumatic elevator, which is now being installed.

PASSED ON THE WAY TO MOUNT LOWE.

One-half of the proposed round-house is at present built and contains 25 pits. It is composed entirely of concrete. A commodious store and office building 300x50 ft., made entirely of concrete with scrap platforms, receiving and shipping platforms, etc., occupies a convenient position near the power house, with tracks placed to facilitate the movement of material.

"Firing Locomotives" is the name of a new book by Angus Sinclair, recently published at this office. It is a very readable, elementary treatise on combustion, and can be carried in the pocket. Price, 50 cents.

Of Personal Interest.

Mr. M. W. Wells has been appointed general manager of the Illinois Southern Railway, with office at Chicago, Ill.

Mr. James H. Manning has been appointed second assistant superintendent of rolling stock on the Canadian Pacific Railway.

Mr. A. Bamseur, superintendent of the Norfolk division, has been transferred to the Charlotte division of the same road.

Mr. B. G. Fallis has been appointed superintendent of the Asheville division of the Southern Railway, vice Mr. G. R. Cone, transferred.

Mr. A. Ramseur has been appointed superintendent of the Ashe division of the Southern Railway, vice Mr. G. R. Loyall, transferred.

Mr. R. J. Johnson, who was trainmaster of the Newcastle division of the Baltimore & Ohio, has gone with the Chicago & North-Western as superintendent of terminals at Chicago.

Mr. W. F. Anderson has been appointed trainmaster of the Danville division of the Southern Railway, vice Mr. H. A. Williams, promoted.

Mr. W. G. Choate has been appointed superintendent of the Washington division of the Southern Railway, vice Mr. A. Gordon Jones, transferred.

Mr. Thomas Fieldon has been appointed general foreman of the Sapulpa I. T. shops of the St. Louis & San Francisco Railroad, vice Mr. T. S. Reilly, resigned.

PASSED ON THE WAY TO MOUNT LOWE.

Mr. F. A. Gascoigne has been appointed car accountant Canadian Pacific Railway, vice Mr. J. P. Driscoll, resigned.

Mr. G. R. Loyall has been appointed superintendent of the Knoxville division of the Southern Railway, vice Mr. C. L. Ewing, resigned.

Mr. H. A. Williams has been appointed superintendent of the Norfolk division of the Southern Railway, vice Mr. A. Ramseur, transferred.

Mr. B. G. Fallis has been appointed superintendent of the Asheville division

Mr. James M. Johnson has been appointed road foreman of equipment, Texas division of the St. Louis & San Francisco Railroad.

Mr. A. P. Cane, trainmaster Norfolk division of the Southern Railway, has been transferred to the Charlotte division on the same road.

Mr. Alexander Holley Rudd has been appointed assistant signal engineer on the Pennsylvania Railroad, with headquarters at Philadelphia.

Mr. W. F. Anderson has been appointed trainmaster of the Danville di-

Mr. F. F. Busteed has been appointed division engineer of the Pacific division of the Canadian Pacific, vice Mr. H. J. Cambie, assigned other duties.

Mr. Webb C. Ball has been appointed chief watch inspector on the Rutland Railroad. He already holds a similar position on the Vanderbilt lines.

Mr. A. Brumer, resident engineer of the Norfolk division of the Southern Railway, has resigned in order to accept a position on the Norfolk & Western.

Mr. B. G. Follis, late of the Iowa Central, has been appointed trainmaster of

the Norfolk division of the Southern Railway, vice Mr. A. P. Cane, transferred.

Mr. S. L. Rainey has been appointed superintendent on the South-Western division on the St. Louis and San Francisco, vice Mr. G. H. Schleyer, transferred to the Texas division.

Mr. H. J. Cambie has been appointed special assistant engineer of the Canadian Pacific Railway, with headquarters at Vancouver, in connection with the Pacific division of the service.

Mr. H. J. Cambie has been appointed with the Railway Appliances Company, with headquarters at Pittsburg, giving his time more particularly to the sale of the Q and C Pneumatic Tools.

Mr. W. E. Dunham has been appointed mechanical engineer of the Chicago & North-Western Railway, with headquarters at Chicago shops, Chicago, Ill., vice Mr. E. B. Thompson, promoted.

Mr. J. P. Driscoll, formerly car accountant on the Canadian Pacific Railway, has been appointed superintendent of car service on the Canadian Northern Railway, with office at Winnipeg.

Mr. Thomas O. Cole has been appointed superintendent of car service on the Lehigh Valley Railroad, with office at South Bethlehem, Pa. The office of car accountant has been abolished.

Mr. Robert L. Langtim has been appointed mechanical engineer of the Denver & Rio Grande Railroad, in place of Mr. Muchnic, who has accepted service with the American Locomotive Company.

Mr. J. D. Hurley and Mr. A. B. Holmes, formerly connected with the Standard Pneumatic Tool Co., are now associated with the Rand Drill Company in the "Imperial Pneumatic Tool Department.

Mr. James Reed, formerly car inspector on the New York Central at Rochester, has been appointed to the position of chief car inspector at the Grand Central Station, New York, vice Mr. James How, retired.

Mr. J. B. Harden, formerly assistant foreman of the Boston & Maine car shops, at East Fitchburg, has been appointed foreman of that company's shops at Portland, Me., vice Mr. George L. Miller, deceased.

Mr. G. W. Seidel has accepted the position of master mechanic on the Burlington division of the Southern Railway. He was, previous to this appointment, master mechanic on the Lehigh Valley at Buffalo, N. Y.

Mr. Eugene McAuliffe, engineer on the Southern division of the Frisco system, was recently appointed road foreman of equipment for that division. He has still more recently been appointed fuel purchasing agent for the entire system.

Mr. J. B. Kilpatrick, who has been master mechanic of the Kansas division of the Chicago, Rock Island & Pacific, with headquarters at Horton, Kan., has been transferred to the Northern district, with headquarters at Cedar Rapids, Iowa.

Mr. R. J. E. Scott, chief inspector of time service on the Canadian Pacific, has also been appointed chief examiner for testing the color sense, sight and hearing of employees engaged in the movement and handling of engines and trains.

Mr. Barney Goodwin, better known among his friends as Buck Goodwin, has recently been appointed traveling engineer of the Philadelphia division of the Baltimore & Ohio, to assist Mr. H. S. Peddicord, who is the road foreman of engines.

Mr. H. A. Williams, formerly trainmaster of the Dansville division of the Southern Railway, has been promoted to be superintendent of the Norfolk division of the same road, with headquarters at Laurenceville, Va., vice Mr. A. Bamseur, transferred.

Mr. Charles M. Muchnie, formerly mechanical engineer of the Denver & Rio Grande, has been made private secretary to Mr. R. J. Gross, of the American Locomotive Company. Both these gentlemen will make a tour of the world in the interest of this locomotive building concern.

Mr. C. P. Coleman, having resigned, the position of purchasing agent has been abolished on the Lehigh Valley Railroad. The duties of the office will be performed by the second vice-president, to whom all communications relative thereto should be addressed, 39 Cortlandt street, New York city.

Mr. James How, chief car inspector at the Grand Central Station of the New York Central, has retired. Mr. How has held this responsible post for twenty-seven years. He was with the Lake Shore before he joined the N. Y. C. Good health and a substantial pension will enable him to enjoy the rest he has fully earned.

Mr. Charles Davenport, one of the pioneer car builders of the United States, died at the home of his son, in Watertown, Mass., in February last. He was the first large builder of cars in this country, and for thirty-two years his firm held a prominent position in that important industry. He died at the advanced age of 91.

Mr. J. P. McMurry, formerly passenger engineer on the Rio Grande division of the Atcheson, Topeka & Santa Fé, has been appointed traveling engineer on the same road. He will have jurisdiction over the lines west of Las Vegas, N. M. Now that he has started in the line of promotion his friends expect to see him reach higher positions as time goes on.

Mr. J. J. Scully, chief clerk in the office of general superintendent of the Central division, Canadian Pacific Railway, was recently married to Miss Cecilia Mallon, of Toronto. RAILWAY AND LOCOMOTIVE ENGINEERING extends its hearty congratulations to the bride and groom, and hopes that the "home" signal may always stand at "clear" for them during a long and happy life.

Mr. Charles S. Powell, who has been associated with the Westinghouse electric interests since 1893, and who, for the past six years, has been manager of the Cleveland office of the Westinghouse Electric and Manufacturing Company, has changed the scene of his activities from the United States to Europe. He has been appointed Assistant Manager of the British Westinghouse Electric and Manufacturing Company, Limited, and has already entered upon the duties of his new position. Mr. Powell, who was one of the most popular men in the electrical business in the United States, is bound to be equally well liked in Great Britain. His headquarters are in the Westinghouse Building, Norfolk street, Strand, London, W. C.

Mr. Thomas Tait, manager of transportation of the Canadian Pacific Railway, has been offered and has accepted the position of Chairman of Government Railroad Commission for the State of Victoria, in the Commonwealth of Australia. The commission is composed of three members, appointed for a term of years. It is absolutely independent of party politics. In this body the chairman has the casting vote, the other two members being departmental officers. The Australian railways are state owned and managed strictly for the benefit of the people, so that they pay about 3 per cent. on the money invested. The offer coming unsolicited, as it did, is considered a great compliment to Mr. Tait himself and to the road he has so long and ably served. Mr. Tait's many friends unite in predicting for him a useful and prosperous career in the land of the Southern Cross.

Wood or Coal?

A passenger of an inquiring mind asked an engineer of an outgoing passenger train the other day, "Does this coal you have on the tender give as much heat as wood would?" The engineer replied, "This engine would not burn wood because it depends greatly on the grate." "Oh, I see," replied the other; "as the engine stands now you greatly prefer coal?" "Yes, I would," said he of the throttle.

Consolidation for the B. R. & P. Ry.

A very good example of heavy freight power in the shape of a consolidation engine has been turned out recently by the Brooks shops of the American Locomotive Company for the Buffalo, Rochester & Pittsburgh Railway. The engines are simple, with 21x28 in. cylinders. The diameter of the driving wheels is 57 in. and the adhesive weight is 164,600 lbs. With a steam pressure of 210 lbs. the calculated tractive force of this engine is about 38,500 lbs.

The valves are of the piston type and the old familiar square steam chest is replaced by the sloping of the valve chamber, on the outside of which a step has been placed for the convenience of those who may have to get from front foot plate to running board. The pistons drive on the third wheel while the eccentrics are placed on the second axle, and a short and nearly straight transmission bar passing over the forward axle gives direct connection gear.

SIMPLE 2-8-0 ENGINE FOR THE B. R. & P. RY.

The spring gear is very compact. The semi-elliptic springs are placed in the space between top and bottom frame bars. Two flat equalizer bars rest on each axle box, inside and outside the frame, their ends terminating in the Brooks webbed hook hanger which carry the spring ends. The forward driving spring is, however, carried above this frame in the usual way. All the driving wheels are flanged. The tumbling shaft casting is also utilized as a bracket for the spectacle plate, and the reach rod is a piece of 2-in. pipe screwed into pin-connection castings at each end.

The boiler is of the wide firebox type, radial stayed and measures 77 in. in the waist and tapers to 70 in. at the smokebox end. There is ample steam space and the boiler contains 2,877 sq. ft. of heating surface. The grate area is about 54 sq. ft. The tender has a coal capacity of 12 tons and the tank holds 6,000 gallons of water. Altogether the machine presents a neat and clear cut appearance.

A few of the principal dimensions are appended for reference:

Weight in working order, [illegible] lbs.
Weight on drivers, [illegible] lbs.
Weight eng. and tend. in work'g order, [illegible] lbs.
Wheel base, driving, 15 ft. [illegible] in.; total, [illegible] ft. [illegible] in.
Wheel base, total engine and tender, [illegible] ft. [illegible] in.
Valves, kind of, piston; greatest travel, $5\frac{7}{32}$ in.
Outside lap, 1 in.; inside lap, 0 in.

WHEELS, ETC.

Dia. and lgth. of driving journals [illegible] in.
Dia. and lgth. of main crank pin jour., [illegible] in.
Dia. and lgth. of side rod pin jour., [illegible] in.

BOILER

Thickness of plates in barrel and outside of fire box, [illegible] in.
Fire box, length, 108 in.; width, 74 in.
Fire box, depth, front, 72 in.; back, [illegible] in.
Fire box plates, thickness, sides, [illegible] in.; back, [illegible] in.; crown, ⅜ in.; tube sheet, ⅝ in.
Fire box, water space, 4 in. fnt.; 4 in. sides; 4 in. bck.
Tubes, number, 354; dia., 2 in.
Tubes, length over tube sheets, 14 ft. [illegible] in.
Fire brick, supported on tubes.

Heating surface, tubes..............	2,672.7 sq. ft.
Heating surface, water tubes......	28.5 sq. ft.
Heating surface, fire box...........	175.8 sq. ft.
Heating surface, total..............	2,877. sq. ft.

Grate surface, 54.4 sq. ft.
Smoke stack, top above rail, 14 ft. 11 in.
Tender, weight, empty, 49,700 lbs.
Wheel base, 16 ft. 5 in.; frame, 13 in. channels.

What Is the Torque of an Electric Motor?

The word torque comes from a latin word meaning to twist, and it may be defined as the twisting or turning effort imparted to a shaft carrying the revolving armature of an electric motor. The torque of a motor such as is used to drive a street car or to run a machine tool in a railway repair shop may be found by experiment. A lever tightly clamped to the shaft is of such length that its free end may be supported upon the platform of weigh scales, exactly one foot from the center of the shaft. As soon as the current is turned on the end of this one-foot lever resting on the scales will press down a certain amount and register what is equivalent to a weight. For the sake of example, suppose the scale registered 4,000 pounds under the circumstances. The torque of this motor would therefore be 4,000 foot-pounds because the pressure exerted by the lever had been measured one foot from the center of the shaft. Continuing the experiment, let us suppose that the lever has been removed and that a pulley has been keyed on the end of the shaft in its place, and further suppose the radius of this pulley to be 12 inches, and that it carries a belt which gives rotation to some other pulley. The torque of the motor remaining the same with given current it follows that the pull on the belt, like the weight registered on the weigh scales, will be 4,000 pounds. Torque is, however, always expressed as foot-pounds. The pulley we have been considering had a radius of 12 inches, or in other words, its diameter was 2 feet. Now, if a pulley 4 feet in diameter was to replace the smaller one, we would have this new condition. The torque being constant with constant current, the pull on the belt would now be 2,000 pounds.

As the torque is found by multiplying the radius of the pulley in feet by the belt pull in pounds, it rests with the designer to make pulley or car wheel, as the case may be, the size best suited to the work to be done. Torque is practically equivalent to the tractive effort of the motor if mounted on wheels 2 feet in diameter.

When the speed of the motor is considered, the horse power may be determined. As the motor revolves a certain number of times in a minute it follows that a definite number of foot-pounds of work must be delivered in that time. If the speed be such that the belt pull would be equivalent to the raising of 33,000 pounds one foot high in a minute, the motor would, under those circumstances, be developing 1 horse power.

"Tunnel Scrapers."

We have often heard the modern high steel frame buildings in New York and other cities called "skyscrapers." In fact the number of them that have of late years been built on Broadway in the lower business end of city has given rise to the curious expression "the canyon of lower Broadway" as a term descriptive of that thoroughfare toward the end of Manhattan Island. We read now in the Charlotte *Observer* that the new engines lately received by the Ashville division of the Southern Railroad are called "tunnel scrapers." It is said that these engines are so high that the tops of the cabs come close to the roofs of the tunnels along that line, and when the water which soaks through the roofs forms into icicles, these engines break them off and grind along the ice with such a noise that makes a new engineer think the tunnel is on top of him—which in a certain sense, it certainly is. It occurs to us in this connection that a chance for a new invention is afforded by this state of affairs, to some ingenious individual. If there should be an upgrade through one or more of these icy-roofed tunnels a traction increaser might be devised by which a pair of skates mounted on top of a suitably braced cab might be pushed up by compressed air against the ice, and so add to the adhesive weight on the drivers. Any ice cut off or knocked down by the skates should be caught in a suitable receptacle and shot into the tank, where it could be melted and eventually used to supply the boiler. This outline of the possibilities of the "tunnel-scraper traction-increaser" is respectfully submitted to Eli Gilderfluke, who in past years has made public some of his choicest devices for making things comfortable on engines, through the columns of RAILWAY AND LOCOMOTIVE ENGINEERING. If Mr. Gilderfluke succeeds in securing a patent, he will not have anything more extraordinary than many of the devices which the United States Government have in years past been asked to issue patents on.

The latest aspirant for notoriety is a self-denominated professor of astronomy in Indiana who pretends to have discovered that the sun is inhabited. When science can demonstrate that a substance can be formed to sustain life, which will live in an atmosphere hotter than the carborundum making furnaces at Niagara Falls, which melt like lead the most refractory substances found on the earth, then it may be demonstrated that some kind of salamander life exists in the sun.

Many a gentleman lives well upon a soft head, who would find a heart of the same quality a very great drawback.—*Old Curiosity Shop.*

Shop Door Fastener.

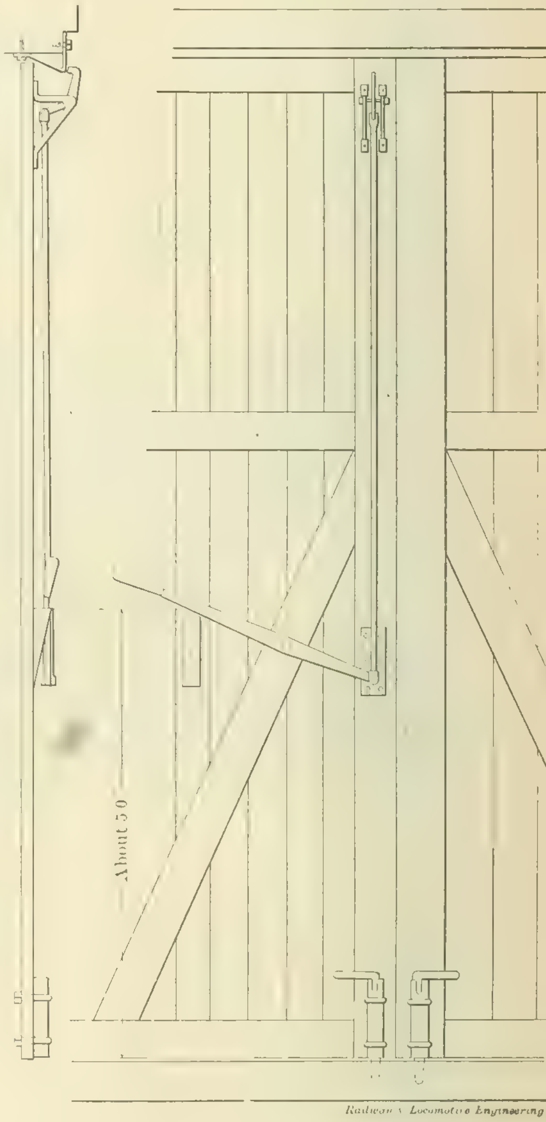
The large doors of shops and roundhouses which are hinged to posts invariably develop the habit of gaping open at the top, and these doors usually become warped sufficiently to render the use of a long bolt at the top impracticable. In dealing with long doors the designer must allow for this habit and endeavor to correct it. He cannot force the door to adopt so radical a departure from its own custom as to swing in tight at the top when it is bolted in place at the bottom. Assistance is what the door requires rather than coercion.

A neat method of fastening such doors as we are describing is in use at the Elizabethport shops of the Central Railroad of New Jersey. At the bottom of the door a simple and easily made but effective bolt is used—no coddling of the door at its lower end is thought of. The bolt consists of a piece of 7-8-inch round iron bent over at the top with a 3-8-inch dowel let in which slides in a slot cut in a piece of gaspipe which encloses the bolt. The pipe is clamped in place by two U-shaped bolts, with nuts screwed up on the inside. The doors are simply closed, the rabbit of one holding the edge of the other, and the bolts are shot without ceremony. The upper end of the door where the warping and gaping take place is out of reach, and a simple piece of mechanism shown in our illustration is used. It consists of a lever which operates a vertical rod, this rod terminating in a knuckle which works between two triangular brackets bolted to the door. From the roof timber of the shop a piece of 2-inch flat iron stands down about three inches and has its lower end bent up so as to form a brace. When the door is open the lever which operates the knuckle is placed so that the handle is in its lowest position, and the business end of the knuckle, which looks like a crooked finger, is "wide open" away from the door as far as it can get. When the door is closed and bolted at the bottom the tendency to gape at the top is kindly but firmly repressed by drawing up the lever handle and sliding it past the inclined bracket until it rests on the top of the stop. This pulls the business end of the knuckle tightly against the flat iron brace and the top of the door comes in line with the bottom and is held securely closed all along its length as a well made door should be. From this it almost looks as if the door was continually up against a thoroughly braced game.

Proper Observance of Signals.

A correspondent writes us interestingly from the view point of an engineer on the subject of proper observance of block signals. His letter is all the more interesting from the fact that his views are somewhat different from those usually expressed in the columns both of the technical and non-technical papers, he being "right on the ground," so to speak, and having experience widely different from those in other departments who quite frequently use these papers for airing their views and opinions.

While block signals on a railroad are intended to afford greater safety for the movement of trains, the fact remains that these signals are sometimes disregarded, either partially or wholly, and especially by high-speed trains having few stops and fast time to make. These fast trains must make their schedule time or else the railroad company may be obliged to pay a forfeit to the passenger at the end of the trip. It is, therefore, highly important that such trains be kept on time, and frequently this is done by the sacrifice of the proper observance of signals by the engineer. Our correspondent writes that an engineer of such a train approaching a block signal which is held against him will generally run much closer than an engineer of an



ROUND HOUSE OR SHOP DOOR FASTENER.

ordinary train would, the former expect ing the signal to "clear." Should the signal remain at danger while the track is apparently clear the engineer believes he can safely go on, and he will often pass the signal and enter the next block in strict opposition to rules. He finds an excuse for so doing in the fact that his train is usually given a clear track, and that other trains are on the lookout for him and know that they should be out of his way. Sometimes they clear him by some minutes less than the rules call for. He knows this, and in his hard fight to maintain his schedule he will enter the block or partially disregard the signal, believing that when the clearance point is reached the conflicting train will be out of the way.

There is a great temptation to the engineer of high speed trains to take advantage of signals in the manner described by our correspondent, for such an engineer is nearly always successful and very seldom an accident happens by his disobeying of the signals, but when it does happen the accident is usually a very severe one, with fatal results. If he is successful in passing signals nothing is said against his action, but if his venture ends disastrously he is punished for disobedihence by discharge. Too often superiors are more or less cognizant of this disobedience, and are often inclined to wink at it. Our correspondent further emphasizes his views by citing a special case. He says: "A passenger agent of a road orders a fast train to compete with a similar train on a neighboring road. The opposition road has powerful engines, substantial roadway and engineers can easily make the time laid out for the fast train. The other road does not have such equipment or roadbed and is taxed to its utmost. If the engineer on the handicapped road shuts off steam and allows the train to drift for 10 or 20 seconds it means a delay of half a minute, or a minute on the run. If he slows down by applying brakes it means delay of from 1 to 3 minutes. If he stops he probably loses from 3 to 8 minutes. Two or three occurrences of this kind, due to block signals or a flagman, would make the train from 5 to 15 minutes late at the end of the run, and the reputation of the road would suffer. The engineer would be blamed for inability to make time. He would be taken off the engine and another man put on who will make time by hook or crook. There is only one way that the second man can make faster time than did the first, who drove the engine to its utmost, and that is by "squeezing" signals, i. e., totally or partially disregarding them, knowing that the dispatcher will endeavor to give high-speed trains the right of way. It is in this manner that much of the time is made on some of the fast trains of today. As long as all goes well the engineer will receive a pat on the back, but if he is unsuccessful in the risks he takes he gets a kick and the whole blame."

Our correspondent further asserts that if passengers knew the peril they are sometimes in and knew the secrets that could be told by the signal blocks and the dispatcher's office at the terminal, some of the swift trains would be taken off and would be found among their more humble companions which the present fast trains now bully and beat to the sacrifice of profitable revenue to the railway company. The engineer would be better off. He would be set a reasonable task, would accomplish much and would not be usually encouraged by subordinate railway officials to ignore certain rules, the successful evasion of which is open reward, and the unsuccessful disobedience of which entails punishment and disgrace.

UNION PACIFIC 4-6-0 TYPE WITH VANDERBILT TENDER.

Baldwin 4-6-0 Engine for the Union Pacific.

Our illustration shows a ten-wheel engine with a cylindrical tender, for the Union Pacific Railroad. This engine is somewhat similar in general construction to others of the same class which have been built for this railroad by the Baldwin Locomotive Works, but this type has been given a wide fire-box overhanging the rear driving wheels, and the tender is of the form designed by Mr. Cornelius Vanderbilt.

The engine is a Vauclain compound, with high pressure cylinders on top. The cylinders are 15½ and 26x28 in. The driving wheels are 62 in. outside diameter, and the engine is expected to take her place in passenger as well as freight service, as occasion demands. The pressure carried is 200 pounds. The tractive effort is about 29,700 pounds.

The boiler is of the wagon-top type and measures 77 in. in the waste and 66 in. at the smoke-box end. The pops are situated in an auxiliary dome which also carries a chime whistle. The heating surface is 2,993 sq. ft., with 47 1-2 sq. ft. grate area.

The Vanderbilt tank contains 7,000 gallons of water and is provided with a running board on each side at the back end for the use of the fireman when taking water. The total weight of engine and tender in working order is 319,210 pounds. A few of the principal dimensions are as follows:

Cylinders, 15½ and 26 in. x 28 in.; Valve balance piston.

Boiler, diameter, [illegible] in.; thickness of sheets, [illegible] x [illegible] in.; working pressure, 200 lbs.; staying, radial.

Firebox, length, [illegible] in.; width, [illegible] in.; depth, front, 71¼ in.; back, 58½ in.; thickness of sheets, sides, ⅜ in.; back, 5/16 in.; crown, ⅜ in., tnbe, ½ in.; water space, front, 4 in.; sides, 4 in.; back, 4 in.

Tubes, material iron; wire gauge No. [illegible]; number 350; diameter 2 in.; length 15 ft. [illegible] in.

Heating surface, firebox, [illegible] sq. ft.; tubes, [illegible]; total, 2,993.2 sq. ft.; grate area, 47.5 sq. ft.

Driving wheels, diameter outside, 62 in.; journals, main, 9 x 12 in.; others, 9 x 12 in.

Engine truck wheels, front, diameter, 30 in.; journals, 6½ in x 11 in.; wheelbase, driving, 14 ft. 6 in.; total engine, 26 ft. 9 in.

Weight, on driving wheels, 140,070 lbs.; on truck, front, 45,140 lbs.; total engine, 185,210 lbs.; total engine and tender, 319,210 lbs.

Tank, capacity, 7,000 gallons.

Tender, journals, 5½ in. x 10 in.

One person can no more quarrel without an adversary than one person can play at chess or fight a duel.—*Martin Chuzzlewit.*

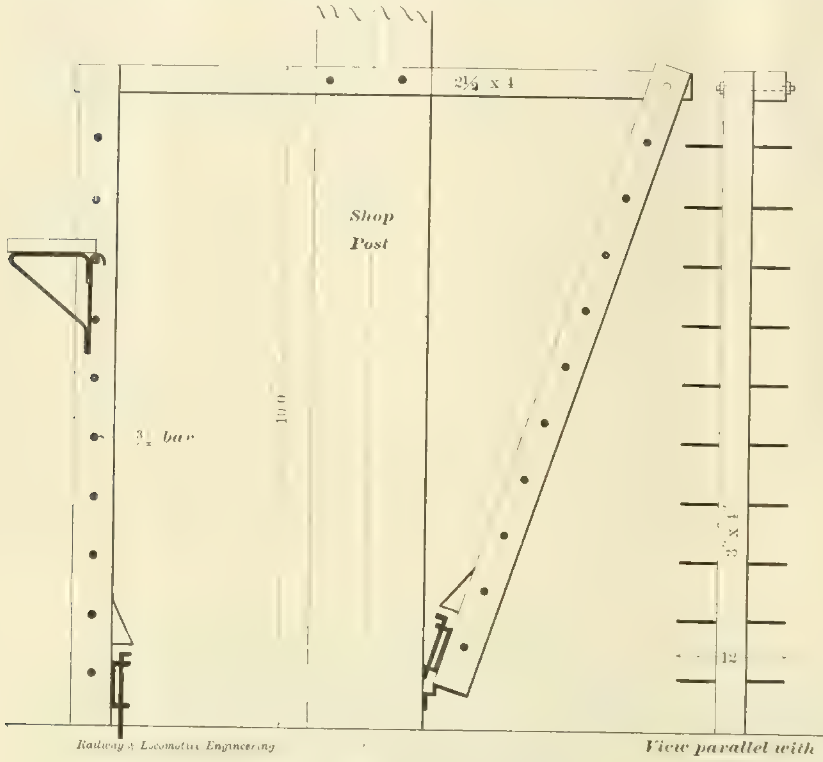
Good Paint Shop Scaffolding.

A very ingenious arrangement for the scaffolding used in connection with the painting of passenger cars is to be seen in the Elizabethport shops of the Central Railroad of New Jersey. On each of the shop posts there is bolted about ten feet from the ground a 2½x4 in. piece of yellow pine, and this crosspiece extends out about four feet on each side of the post. From the ends of this cross bar two uprights are pivoted, their lower ends resting upon the floor. A bolt which passes into the concrete prevents the upright being moved, though when the bolt is withdrawn this 3x4 in. post may be swung back out of the way, as shown in our illustration. In each one of these upright posts there are ten pegs made of 3-4 in. round iron spaced a foot apart, all except the lowest, which is about half that distance from the floor. These pegs stand out 4 1-2 in. on each side of the uprights and are parallel to the passageway between the cars.

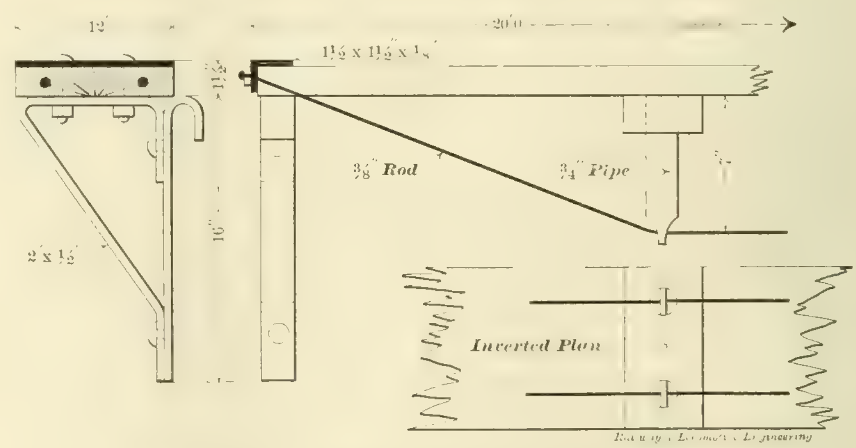
The plank upon which the workmen stand is made of selected spruce 12 in. wide, and is supported at each end on a bracket with a hook at the right angle of the triangle which it forms, as may be seen in the accompanying sketch. The hook is dropped over one of the pegs in the uprights and the lower point of the bracket rests against the peg next lower down, so that when in place the footboard is really supported by two cantilevers, one at each end. The ease with which the board can be raised or lowered is plain to be seen.

The plank itself is trussed with two 3-8 in. truss rods, each carried under two queen posts 7 in. deep, which gives the unloaded plank a camber which can hardly be detected by the eye. The ends of the plank are covered by two small angle irons, which support the truss rod nuts and take the bolts which secure plank and triangle together. The queen posts are made by taking lengths of ¾ in. pipes, 15 in. long and flattening them in the middle and shearing them through in the flattened portion. These pieces of pipe are then placed in two holes in cross battons screwed to the under side of the plank, the truss rods being run through and tightened up, completes the job.

The whole arrangement is simple, strong and effective. There is no counterbalance to get out of order, and great economy of space is secured. The pegs act as ladders and as they stand parallel to the passageway they cannot strike men or material moving past.



END VIEW OF SCAFFOLDING.



DETAIL OF TRUSSED PLANK AND SUPPORT.

"Railways on the Ocean."

The Canadian Pacific Railway has lately acquired possession of fourteen steamships belonging to the Elder-Demster Line, the aggregate dead weight tonnage of which amounts to about 130,000 tons. It is believed that about $8,000,000 was the purchase price. These vessels will be used largely in the North Atlantic trade. This railway company already has a fleet on the Pacific ocean, and when things are in working order it may possibly be able to lay claim to being the transportation company covering the largest land and sea mileage in the world. The *Pall Mall Gazette*, of London, thinks that this "deal" is a serious blow to independent Canadian shipping, for it says nearly the whole of the North Atlantic trade will be dominated by American railway companies. The Canadian Pacific has also some fine steamships of the ocean-going type on the Great Lakes, plying between Port Arthur and Owen Sound.

We have received an interesting publication got out by the Lackawanna Railroad called "Modernizing a Trunk Line," which is a story of the permanent improvements on the D., L. & W. since 1899. A number of neatly executed half-tones show new stations and bridges. The work has been very extensive and thorough. A copy will be sent to any one interested who applies to the railroad company for it.

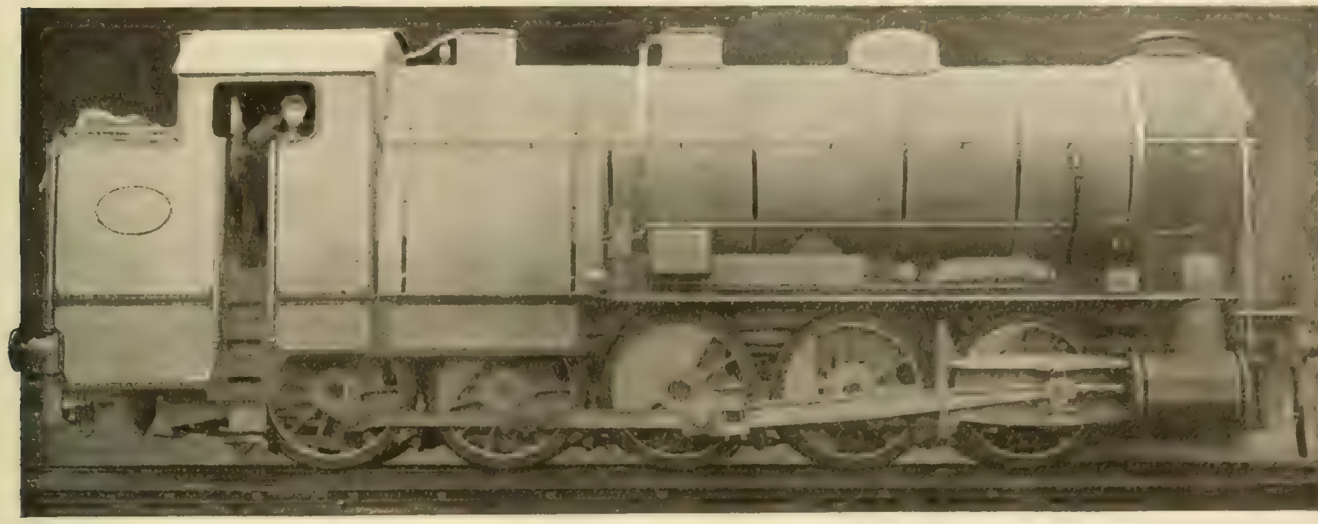
We have been informed that the gross earnings of the Chicago, Great Western Railway (Maple Leaf Route) for the first week of March, 1903, show an increase of $18,202.23 over the corresponding week of last year.

Novel Suburban Engine on the Great Eastern of England.

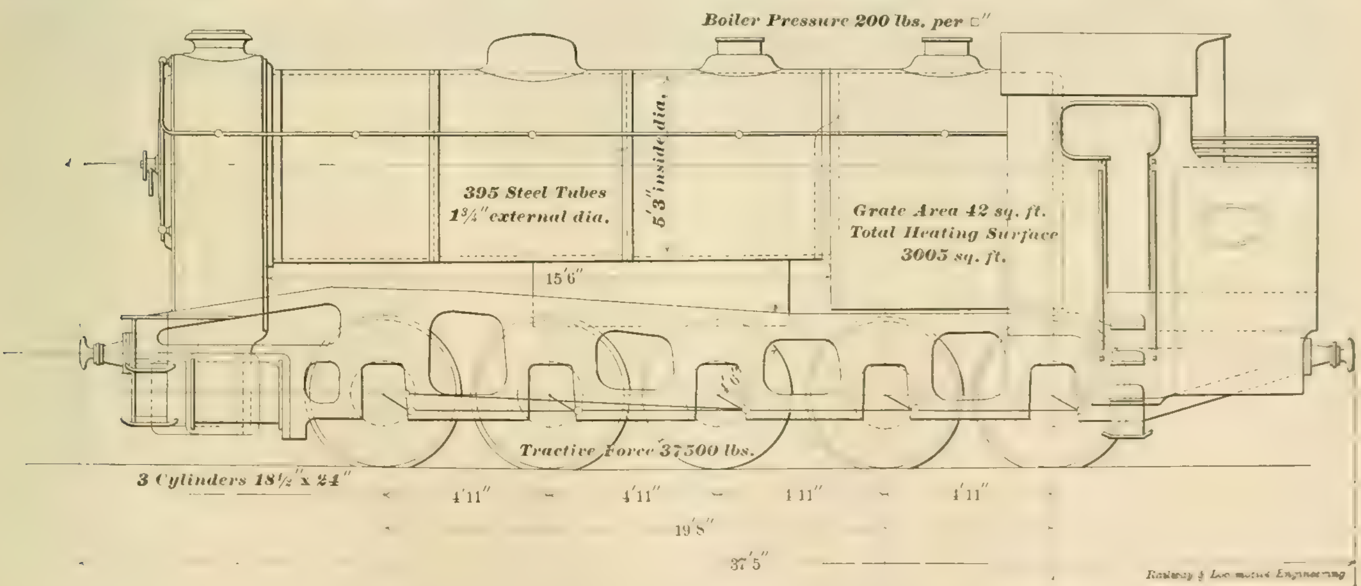
Mr. James Holden, locomotive superintendent of the Great Eastern Railway, has designed a powerful suburban engine, which is intended to haul trains of about 370 long tons and carrying each about 1,200 passengers. The traffic is such as to require about 15 stops and starts in a distance of ten and three-quarter miles, between London and Enfield, and it is proposed to cover the distance in 30 minutes.

The engine is built up very close to the loading line of the road and weighs about 156,800 lbs. All the weight rests upon the five pairs of drivers, including that of fuel and water. The cylinders are three in number, all simple, 18½x24 inches. The two outside ones drive on the third pair of wheels while the center cylinder, placed directly below the smoke box, drives upon a crank axle in the second pair. All the cylinders are horizontal, and the eccentrics are secured to the third axle. There are only two steam chests, one is for the left cylinder and one for the right and middle. A curious arrangement is the connecting rod for the center cylinder. It is a forked rod, and the wrist-pin connection is a separate piece bolted between the upper and lower bars of the forked end. When in place this rod entirely encloses the forward axle, and as the opening so made is not long enough to clear the axle when the piston is at the back end of the cylinder, the leading driving axle is offset in the center to suit. As the leading pair of drivers are revolved by the side rods the forked rod and the off-set axle each work in perfect harmony.

The boiler has a wide firebox, with grate area of 42 square feet, and the total heating surface is 3,005 square feet. The tubes are 395 in number and they are 1¾ inches in diameter and are 15 feet 11 inches long. As the boiler stands so high, the chimney has been brought down in consequence, and is flared out inside the smoke box so as to be practically an upper petticoat pipe. The exhaust has three annular openings. The pressure carried is 200 lbs., and an estimate of the tractive effort places it about 37,500 lbs. The cranks are set at 120 degrees, and in balancing the total of all the reciprocating weights has been taken, instead of two-thirds of them, as is the usual practice. The provision against slipping in making a start is accomplished by a sanding device which uses compressed air, which latter is supplied from a separate reservoir. Air is pumped into the sander's reservoir and passes through a check valve into the main reservoir, so that even if air is temporarily used freely in sanding, it cannot affect the main reservoir pressure. There are 1,300 Imperial gallons of water carried, and about two tons of coal.



HEAVY THREE-CYLINDER SIMPLE SUBURBAN ENGINE, GREAT EASTERN RY



OUTLINE OF HEAVY SUBURBAN ENGINE, GREAT EASTERN OF ENGLAND

The Britannia Tubular Bridge.

Our illustration shows a view of the Britannia Tubular Bridge over the Menai Strait, which latter separates the island of Anglesea from North Wales. The bridge is on the Chester and Holyhead Railway and was built in 1845 by Robert Stephenson. It is really two bridges composed of four tubes each, the center ones being 460 feet long. The whole structure stands at a height of 102 feet above high water mark. The tower, which is built upon a small rock near the center of the stream, is called the Britannia tower, and the height of the tube here is 30 feet; it diminishes to 22 ft. 9 in. at the abutments. The bottom of the bridge is straight, while the top is made in the form of a true parabolic curve. The interior width is 13 ft. 8 ins., and the total length is 1,841 feet. The sides of the tubes are wrought iron plates riveted together, but the top and bottom are composed of a number of smaller tubes or cells, which give additional stiffness to the whole tube. The bed plates in the shore towers and in the abutments on which the tubes rest, move freely on cast-iron rollers and balls. The difference between the summer and winter lengths is fully 12 inches. The total weight of iron used was nearly 12,000 tons, of which the tubes contain about 9,360. There are 1,015 tons of cast-iron used, and 175 tons of permanent railway, and it is said that more than two millions of rivets were used. The total cost was about $2,919,700. It was completed in less than five years. It was in March, 1850, that the first train passed through the bridge. In our illustration the spectator is supposed to be on the island and is looking toward Caernarvonshire, across the strait.

Be Fair and Just.

Are not some of our railways of to-day making a serious mistake in adopting the harsh measures accredited to them? Will it not have a tendency to turn our bright young men to other pursuits, unless these restrictions are removed? I refer to the hearing test and the age limit. We need intelligent men to-day more than ever to make our railways successful. No sane man will take up an engineer's profession, or any other, that prevents him from making a living at it after he has reached the age of 35, he really enters the prime of life then. What is there about a locomotive engineer's profession that he should hear a watch tick forty inches from the ear? Why, 90 per cent. of our male population can't accomplish that feat, and I doubt if their friend (?), the originator of the clause in their rules, could hear one at that distance.

Has it not a tendency to make the medical examiner—if he is a man with lots of ambition but little practice—dishonest? I have heard of just such a case. No doubt the management wants to be fair, but certainly the conditions have been misrepresented to them. Not a click around an engine escapes the experienced engineer, and still he may be unable to hear his watch away from his ear. If he should conclude to follow some other business at 35 or later (and he invariably makes a failure at anything else), he has lost out entirely because the pension clause puts the limit at 35 at which he could be re-employed. Did you ever hear of a man being old at 35 in any other profession? Grand idea that pension, but put it after 35 instead of 70. Very few men will live to see 70, and run our battle-ships of to-day. If the pension must stand, why not insert a clause, that a man hired after 35 shall not be entitled to one? Don't ask him to be physically perfect, an accident on your own line, over which he had no control, may have made him otherwise. A much better plan would be to rid yourself of incompetents, gamblers and saloon habitues, if you have any, and hire good men. Again, you can elevate the morals and standing of your men by starting local clubs, which every engineman should be expected to join. Make your master mechanic the official head, and have him preside over them. Start topical discussions pertaining to their business, you can find lots of them every month in Railway and Locomotive Engineering—and the results will amply repay you in better service and increased revenue. An ignorant man has no business on a railway. The public asks and pays for first-class service, and you can only accomplish it by employing intelligent men to man your engines. *Ignorance and a stake road go hand in hand.* You don't want that kind of a reputation. Don't discourage but encourage the coming generation and take care of the good men of to-day. Be fair if you want results. J. A. Baker.

BRITANNIA TUBULAR BRIDGE OVER THE MENAI STRAIT.

A Unique City by-the-Sea.

Atlantic City has no season. It is perennial. It has broken a tradition that a seashore resort is necessarily a summer resort. It took daring and imagination on the part of the first man who decided to spend his winter vacation at a famed summer place, and even more of the same quality on the part of the hotel keeper who decided to keep his house open to provide lodgings for whoso might follow in the trail blazed by the daring innovator. The experiment succeeded a decade ago. The Gulf Stream made it so. Geographically Atlantic City is the most favored resort on the North Atlantic Coast. Its great temperature regulator is the Gulf Stream, which approaches the land nearer at this point than at any other place north of the Carolina coast. Thus the ocean winds that come breezing out of the east are tempered to the winter sojourner and made almost balmy and free from chill.

There are fun and amusement a-plenty for the person who is seeking recreation and not health. The Casino has an excellent ballroom, and a commodious white marble swimming pool of sea water, warmed to a comfortable temperature for bathing, no matter what the season. There are bowling alleys and sun parlors with commanding views of the ocean and esplanade. Three long ocean piers are additional places of re-

sort and amusement. They are kept comfortably heated when the temperature demands. For the large contingent who devote their time to outdoor sports there are the golf links.—*New York Post.*

The New Jersey Central has a double daily service to Atlantic City from New York, leaving the latter city from foot of Liberty street at 9:40 a. m., 3:40 p. m. Send to C. M. Burt, General Passenger Agent, New York, for illustrated Booklet and Time Table. It's free for the asking.

"She Walks the Waters Like a Thing of Life."

We are indebted to the master mechanic of the Ohio River Division of the picturesque B. & O. for the photograph from which our illustration was made. The high water, which was something over 10 inches, covered the track, as shown, on March 3 of this year. The photograph was taken in front of the Parkersburg, W. Va., shop of the Baltimore & Ohio, and gives us a passenger train "passing through the deep." The wave which flows off from the pilot is very like the waves which originate as the bow of a fast steamer cuts through the briny. The solitary figure on the left is that of our friend, the M. M., who appears to be standing in rubber boots nearly knee deep, and waiting, not for the clouds, but for the waves to roll by. We have not been informed whether the engineer took advantage of this state of affairs and scooped up some water into the tank, for the pumping of which the company had not been compelled to pay. It must have been a unique experience for all concerned.

WADING PAST THE ROUND HOUSE KNEE DEEP.

There is nothing innocent or good that dies and is forgotten. Let us hold to that faith or none.—*Old Curiosity Shop.*

A Useful Device for Railroads.

The *Railway Critic* informs us that "A modern development of the old-fashioned hydraulic ram in the form of a direct-acting machine, utilizing all the force of the water feeding is one of the latest contributions to railroad equipment. The machine, known as the Niagara hydraulic engine, is rapidly supplanting the steam pump and the necessary boiler, and coal supply at tank stations, and is being utilized to furnish water for general locomotive work. This machine needs no engineer and fireman to run it. An occasional glance from a section boss is all that is required, and the greenest hand in the section gang can regulate it to pump all the water required for the tank. Railroad tanks are located where running streams may be depended upon for a water supply, and here one of these engines can be installed for less than the annual pay for a competent engineer. For electric railways the supply of water for power-house purposes is satisfactorily accomplished at little expense by one of these engines, and for the sprinkling of tracks or toll-roads the installation of one of these machines will save its cost in meter charges in a single year."

The Allis-Chalmers Company will on May 1 remove their general offices from the present location in the Home Insurance Building to the New York Life Building, corner of Monroe and La Salle streets, Chicago. The Allis-Chalmers Company has for the past two years been expending large sums of money for betterments at their various plants in Milwaukee, Chicago and Scranton, so as to secure the best possible service in point of economy and quick delivery. To give a fair idea of the

scope of the business conducted by the Allis-Chalmers Company, we are informed that during the past two months orders for either engines, mining machinery, rock crushing machinery, saw mill machinery, or flour mill machinery were booked from every State in the Union, besides the following foreign countries: England, South Africa, Mexico, Canada, Chili, Central America, Brazil, West Australia, Turkey, Finland, Yukon Territory, Belgium, British Columbia, Bolivia, Hawaiian Islands, Peru, Alaska, China and the Philippine Islands.

An Irishman was filling barrels with water from a small river to supply a village which was not provided with waterworks. As he halted to give his horse a rest a gentleman rode up and asked:

"How long have you been hauling water, my good man?"

"Tin years or more, sor."

"Ah! And how many loads do you make a day?"

"From tin to fifteen, accordin' to the weather, sor."

"Well, Pat," said the gentleman, laughing, "how much water have you hauled altogether?"

The Irishman jerked his thumb in the direction of the river, at the same time giving his horse the hint to start, and replied:

"All the wather that yez don't see there now, sor."—*Chums.*

Steel Shutters.

The catalogue of the Columbus Steel Rolling Shutter Company, of Columbus, Ohio, show the form of construction mechanism and uses of the steel rolling doors. The construction of the slats is very ingenious; on the weather side there are no pockets or recesses for the accumulation of water, dirt, snow or sleet. The rounded cylinder formation which is necessary at each edge of the slat does not weaken or crack the metal at the joint and such slats are also not liable to spring and thus successfully resist wind pressure and general hard usage. They can be readily used for round-house doors, and their vertical lift does away with the danger of swinging or being blown against a moving engine. Unlike the ordinary hinged engine-house door, these steel ones cannot gape open at the top, and allow an inrush of cold air. This form of construction can be used as a fireproof shutter on windows. A copy of the catalogue, or other information may be had by applying to the company.

It may be interesting to some of our readers to know the formula for calculating the tractive power of a locomotive with three simple cylinders of equal size such as Mr. Holden's heavy suburban engine now running on the Great Eastern of England. The formula is:

$$T = \tfrac{3}{2} \text{ of } \frac{d^2 \times s \times p}{D}$$

where d is the diameter of the cylinder in inches, s is the stroke, p is the mean effective pressure in the cylinder, and D is the diameter of the driving wheels in inches.

The Joseph Dixon Crucible Co., of Jersey City, have a set of pencils made specially for the use of car inspectors. They are like two Woods who were examined before a magistrate, both hale and hearty men about eighty years old. The magistrate found that the first one had never smoked or used liquor, while the other brother admitted that since manhood he had seldom "gone to bed sober." "Well," exclaimed the judge, "it seems to me that the best way to preserve a wood is to keep it very dry or very wet." Those car inspectors' pencils are designed to work very dry or very wet, and they are good for it. The advertisement department sent us a pair of these versatile pencils in mistake, and they are just the thing for marking copy. They have the merit of leaving a plain mark that stays there.

During the scarcity of anthracite a good many people were compelled to burn soft coal in their house furnaces, with the result that enormous quantities of soot were deposited, because of the difference in drafting required by each kind of fuel. A remedy offered in the daily press at the time was the use of a little scrap zinc of any kind thrown on the fire, and those who tried it appeared to be satisfied. The vapor of zinc has an affinity for carbon, and in passing up the chimney causes a chemical reaction to take place, and the soot disappears. Of the resultant compounds one goes out of the chimney with the smoke and the other falls back and is eventually shoveled out with the ashes.

In the sequel to *Alice in Wonderland* the White Knight who claimed to be of an inventive turn of mind said to Alice, "I heard him then, for I had just completed my design, to keep the Menai bridge from rust by boiling it in wine." This may have been a capital plan when used amid the marvelous scenes through which Alice traveled, but in the work-a-day world as we know it the problem of preserving steel cars has to be solved by less expensive and less bibulous means. The Protectus Company, of Philadelphia, have just sent their friends a neat little card with a half-tone of the high side steel hopper gondola recently designed by Mr. Cornelius Vanderbilt,

which has been coated with Protectus paint. This material is used on trucks, bolsters, bridges, and in fact anywhere where steel is exposed. The trade mark of this company is a black knight in full armor, and his presence on the card suggests the comparison between his practical and modern way of preventing rust, with that of his amusing prototype in Lewis Caroll's well known child's story.

Railroad Hospital.

An emergency hospital car has been put in operation on the Delaware Division of the Erie Railroad. It is said that the Westfield accident prompted the management of the Erie to make trial of an hospital car. The car itself is equipped with all the modern appliances of medicine and surgery. In the central portion are six single iron cots, with woven wire springs and hair mattresses, and these beds are covered with soft all-wool blankets, white sheets and each bed has a rubber sheet and one feather pillow incased. In an end compartment there is a complete surgical outfit consisting of an operating table, towels, basins, brushes and all necessary appliances. Another feature of the car is its equipment with tools for the use of workers at a wreck. There are saws, axes, chains and hooks, ropes, shovels, crowbars and pickaxes. A Babcock fire extinguisher for hand use has been provided. It is said that if this car proves its usefulness another may be put on the Buffalo Division.

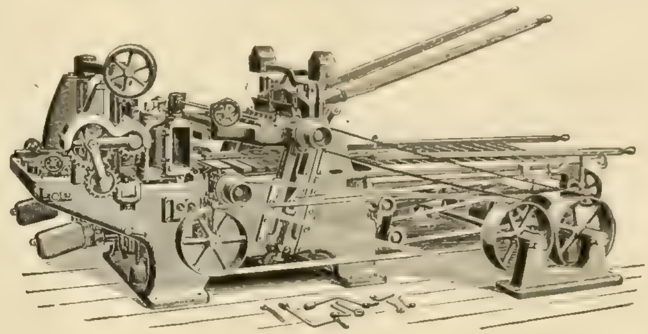
An Optical Illusion.

Box Tunnel between Bath and Bristol in England is not only perfectly straight, but the railway track is perfectly flat also. When you approach the yawning mouth of the tunnel all is black and dismal-looking; but immediately you enter the dark portal you see the other end of the tunnel, some three miles away, and so near does it appear that you can apparently emerge at the other end in a few steps. But as you proceed the other end gradually recedes, and by the time you are half way through it is quite small. The illusion is very curious.—*Queensland Railway Times.*

Endless Bed Timber Planer and Jointer.

We are pleased to show our readers in general and car builders in particular a cut of a new machine especially designed to meet the requirements of the latter class. It is built for heavy surfacing, on either one or both sides, as desired. It works stock on two sides 30 inches wide and 14 inches thick, and will plane in a very superior way the four sides of a timber to 28 inches wide and 14 inches thick. It will plane at one operation two sides and one edge of two pieces up to 12 inches wide and 14 inches thick. The feeding mechanism consists of a traveling bed supported on four steel-faced ways, over which are placed two divided rollers, and under these two boards of unequal thickness can be placed and fed at the same time.

The cylinders, pressure bars and rolls have easy, quick and accurate adjustments, with a view of making all as labor-saving as possible, and when necessary to change the thickness of the material being worked it can be done



ENDLESS BED TIMBER PLANER AND JOINTER.

from the operating end of the machine without loss of time. Feeds from 40 feet per minute and up are furnished, as desired.

The makers of this labor-saving machine, J. A. Fay & Egan Co., of No. 445 West Front street, Cincinnati, Ohio, will be glad to hear from those interested, to whom they will send full details and terms, together with cuts showing the machine to advantage. Their new 450-page catalogue showing and describing every machine they make, will also be furnished on application to those writing for it.

Ancient and Modern Books.

Ecclesiastes, or the Preacher, has said, "of making many books there is no end; and much study is a weariness of the flesh." There are some people who are inclined to quote this saying in disparagement of books in general and of all study. The saying no doubt applied in ancient days, but the "books" were then very different from what they are to-day. They were then much more difficult to write, and it is perfectly fair to suppose that the authors were not specialists on the subjects they wrote on in the sense

that they are to-day, and, moreover, it wasn't everyone who could read the so-called books when they were written. To-day the making of books is without end just as the Preacher said, but the study of the wonderful laws of nature as presented in modern books is by no means a weariness of the flesh. As a matter of fact, for a seeker after truth, it is a downright pleasure to read, and so drink in accurate knowledge. The air brake, the distribution of steam, and its action in the cylinder, and hundreds of other things which the railroad man encounters in his daily life, depend upon the action of the laws of nature. Look over the subjoined list of books and see for yourself if the study of them is likely to be wearisome. Using, good, accurately written books will be found to be a healthy, bracing mental exercise by means of which the mind grows stronger by the understanding of facts. To read intelligently now-a-days is to gain knowledge.

A year's subscription to RAILWAY AND LOCOMOTIVE ENGINEERING costs only $2.00, and the paper is a welcome visitor in every household, especially where there are children.

"The World's Railway" is a most interesting history of railways and locomotives. It is beautifully illustrated and the net price used to be $10.00. We now give it and a year's subscription to the RAILWAY AND LOCOMOTIVE ENGINEERING for $5.00.

"Locomotive Engine Running and Management," by Angus Sinclair, is an old and universal favorite. A well-known general manager remarked in a meeting of railroad men lately, "I attribute much of my success in life to the inspiration of that book. It was my pocket companion for years." We sell it for $2.00.

"Practical Shop Talks." Colvin. This is a very helpful book, combining instruction with amusement. It is a particularly useful book to the young mechanic. It has a stimulating effect in inducing young men to study their business. Price, 50 cents.

"Examination Questions for Promotion." Thompson. This book is used by many master mechanics and traveling engineers in the examination of firemen for promotion and of engineers likely to be hired. It contains in small compass a wonderful amount of information about the locomotive. Convenient pocket size. We cordially recommend this book. Price, 75 cents.

"Compound Locomotives." Colvin. This book will instruct a man so that he will understand the construction and operation of a compound locomotive as well as he now understands a simple engine. Tells all about running, about breakdowns and repairs. Convenient pocket size, bound in leather, $1.00.

"Catechism of the Steam Plant." Hemenway. Contains information that will enable a man to take out a license to run a stationary engine. Tells about boilers, heating surface, horsepower, condensers, feed water heaters, air pumps, engines, strength of boilers, testing boiler performances, etc., etc. This is only a partial list of its contents, question and answer style. 128 pages. Pocket size, 50 cents.

"Care and Management of Locomotive Boilers." Raps. This is a book that ought to be in the hands of every person who is in any way interested in keeping boilers in safe working order. Written by a forman boilermaker. Also contains several chapters on oil-burning locomotives. 50 cents.

"Locomotive Link Motion." Halsey. Any person who gives a little study to this book ceases to find link motion a puzzle. Explains about valves and valve motion in plain language, easily understood. $1.00.

"Machine Shop Arithmetic." Colvin and Cheney. This is a book that no person engaged in mechanical occupations can afford to do without. Enables any workman to figure out all the shop and machine problems which are so puzzling for want of a little knowledge. 25 cents.

"Firing Locomotives." Sinclair. Treats in an easy way the principles of combustion. While treating on the chemistry of heat and combustion is easily understood by every intelligent fireman. 50 cents.

"Air-Brake Catechism." Conger. Nothing better can be found for persons trying to learn all about air brakes. Tells the whole story. Cloth, 75 cents. Leather, $1.00.

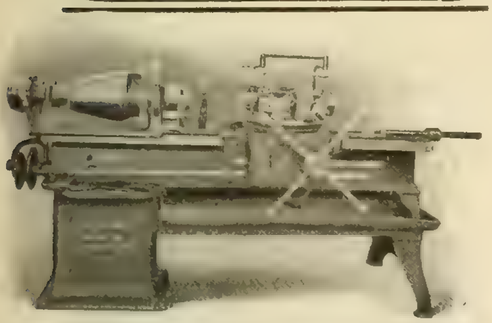
"Skeevers' Object Lessons." Hill. A collection of the famous object lesson stories which appeared in this paper several years ago. They are interesting, laughable and best of all they are of practical value to-day. $1.00.

"Stories of the Railroad." Hill. Best railroad stories ever written. Those who have not read these stories have missed a great literary treat. $1.50.

"Block and Interlocking Signals." Elliott. Tells what signals are, what they do and how they do it. Comprehensive treatise on the subject. Ought to be studied by all trainmen where block signals are used. $3.00.

RAILWAY AND LOCOMOTIVE ENGINEERING. Bound volumes. $3.00.

We regret that owing to the vast amount of detail work connected with our air brake chart, our engravers were not able to get it ready to issue with the March number. The chart accompanies this paper, and any one who by accident or otherwise fails to receive a copy is requested to notify us of the fact.



It is occasionally quite possible in railway shop equipment to save money and buy "something just as good." At the Elizabethport shops of the Central Railroad of New Jersey there is an example of this. Instead of buying an expensive receptacle for the acid used in cleaning the brass work from the interior of passenger cars, a cheap but satisfactory substitute has been installed. A plate of thick common glass such as is used for lighting rooms beneath the sidewalk was bedded in concrete, and upon this two lengths of large vitrified sewer tile were placed with flare ends uppermost. The joints were run with sulphur, and a satisfactory vat for strong acid was thus secured. The tiles being over and above after the sewer for which they were intended had been built, were like good material found upon the scrap pile.

The Union Switch & Signal Company's Bulletin No. 11 deals with continuous light semaphore spectacles. The object of these spectacles is briefly to display the normal night indication whether it be the "danger" or the "caution" indication until the semaphore arm has traveled more than two-thirds of its arc toward the "clear" position. To prevent the display of a "clear" night indication under similar conditions, and also to prevent the total eclipse of the signal light at any point in the transit of the signal from one indication to another. These are very important points in a night signal. In the daytime an engineman can easily determine by the angle the arm makes with the post what signal is intended to be given, but at night he must depend entirely upon the light. The company will be happy to send this bulletin to any inquirer who will write to them, at Swissvale, Pa.

It is not surprising that more than twelve thousand out of the one hundred and sixty-eight thousand men on the payrolls of the United States Steel Corporation have applied already for stock under the generous profit sharing plan which has been laid before them. The recently published figures of the gross and net earnings of this colossal organization are so impressive that the eagerness of the wage workers for a part of the gains is natural and commendable.—*New York Tribune.*

The Bullock Electric Manufacturing card calendar for March has been received. It is one of a series in which a few words of biographical history concerning eminent scientific men is given. The March card is about Charles Darwin. He was educated at Edinburgh and Cambridge, and was only an average student. His scientific career practically began when he was appointed naturalist on H.M.S. Beagle. It was on the cruise of this ship that Darwin was brought into close contact with nature, and his careful and minute observation at this time laid the foundation for his notable works, the "Origin of Species" and the "Descent of Man." Incidentally it may be mentioned that Darwin was not responsible for the popular view of his celebrated theory. He did not believe the human race had sprung from monkeys, but that man and the higher apes had sprung from a common ancestor. The Bullock Electric Company will be happy to send any of the cards of their interesting series to those interested enough to apply to their office at Cincinnati, Ohio.

Four large freight locomotives belonging to the Baltimore & Ohio were recently engaged in what was most truly an errand of mercy. Fire broke out in the business portion of the town of Mount Airy, which is described as a thriving hamlet of about 3,000 inhabitants. The town was without fire protection, and a strong wind was blowing at the time of the fire. An appeal for aid was sent to the town of Frederic, twenty miles away. The Frederic fire brigade were dispatched on a special train and were able to check the spread of the fire. Water was supplied to the fire engine by four freight locomotives, each having a 7,000-gallon tank. The supply was kept up by these engines, one or two at a time going for water to near-by stations, while the others remained on the spot and allowed the H_2O contents of their tanks to be emptied on the flames by the busy little "steamer" from Frederic.

We have been informed by the E. J. Ward Company that they have turned over to the Railway Appliances Company their car vestibule diaphragm business and have withdrawn themselves entirely from that department of railway supplies. The Railway Appliances Company have purchased the entire stock of diaphragms, material and machinery and removed the manufacture to Chicago Heights, where they have increased facilities for doing this business. The E. J. Ward Company, it will be remembered, have been the pioneers in the canvas diaphragm business, making car vestibule diaphragms of all varieties. They have introduced the riveted diaphragm made under their patents, which, together with other forms, has been transferred to the Railway Appliances Company.

To Reduce Noise.

Mr. F. W. Everett, acting superintendent of the New York Central, has issued a circular which is intended to re-

duce noise at the company's terminal stations. Among other things the circular calls attention to the noise caused by rough handling of cars, men shouting instead of giving signals by hand or lamp, car inspectors and oilers letting journal-box lids close with a bang, unnecessary bell-ringing, the boisterous and wasteful pop, and the general all-round reduction of loud talking is required. The elimination of noise may also have a money value, because if no unnecessary noise-producing violence is permitted wear and tear will be reduced, all of which will add to the comfort of patrons of the road and incidentally tend in the direction of economy.

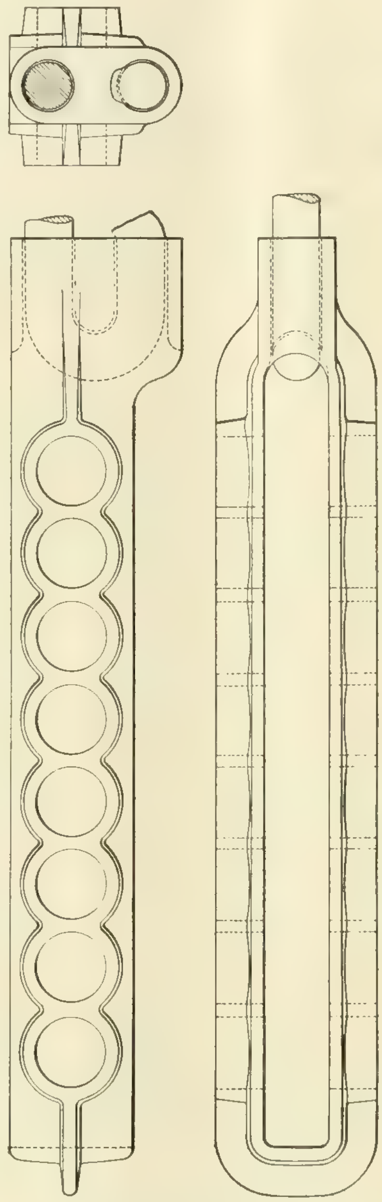
National Malleable Iron-Brake Jaw and Dead Lever Guide.

The devices shown in the accompanying illustrations are, Fig. 1, the Brake Jaw, and Fig. 2, the Dead Lever Guide. The principal feature common to both is the method of attaching the rod. This is done without welding, which is necessary where a forged rod or guide is used. A connection is thus insured which is absolutely reliable, all welding being dispensed with, the danger of accident from imperfect welding is thus avoided, the rod does not require upsetting to form a head, and it is not necessary to drill connection pin holes.

The application of the rod to the jaw is very simple. The jaw is slipped onto the rod through one of the two parallel holes in the end of the casting, then the end of the rod is bent into the form of a pot hook over a mandrel and slipped through the other parallel hole. The end is then slightly bent over to prevent the jaw slipping back. That the jaw is sufficiently strong and can absolutely be relied on will be seen from the following report of test made at the Rose Polytechnic Institute:

"The jaw was fitted with a 3-4-inch iron rod, and with the stub end of a lever fitted in the end between the jaw. It was then put in a Rhielé testing machine and the pulling strain applied. The iron rod broke at 22,500 pounds. A bar of crucible steel was then applied instead of the 3-4-inch iron, and the jaw again submitted to the pulling of the machine. This crucible steel broke at 35,100 pounds strain, and we were unable to find anything sufficiently strong to hold the jaw to the breaking point of the casting. At the conclusion of the test the jaw was apparently in good condition, with the exception that the holes for the pin were slightly elongated, but not sufficiently so as to cause any difficulty in removing the pin."

These jaws and dead lever guides have been in service for five years, and a broken one, it is said, has never been reported, although there are at the present time over one hundred thousand of them in use. Many railroads and private car lines in all sections of the country are now using these jaws. The jaws and guides can be furnished for 3-4-inch, 7-8-inch and 1-inch rods, and the jaws with either one or two connection pin holes. Prices and any further information will gladly be furnished on application by The National Malleable Castings Company, of Cleveland, Ohio, by whom these devices are manufactured.



NATIONAL DEAD LEVER GUIDE.

Japanese Description of Train Movements.

The Japanese are said to acquire foreign languages very readily, but they sometimes conclude prematurely that they understand a language when they have only learned the meaning of isolated words. The *Railroad Gazette* has picked up a Japanese railroad advertisement which reads: "The through train services between two terminals of OSACA

and NAGOYA are operated five times, of which two being the EXPRESS TRAIN from either terminus per day, with all the carriages of bogie system which accompany a uniformed attendent and provision sellers making themselves to be useful."

The Chicago Pneumatic Tool Company report that the removal of their factory at Aurora, Ill., to Cleveland, O., and its consolidation with the Cleveland plant, has been definitely decided upon, and the alteration will take place in the near future. This move has been under contemplation for some time, and will, when consumated, undoubtedly result in benefit to both the Chicago Pneumatic Tool Company and its numerous patrons. The consolidation not only makes more economical production possible, but will also largely increase the output. The constantly increasing business of the company has shown conclusively for some time past that it would be necessary to largely increase facilities in order to adequately fulfil requirements, and it is hoped that this move will have the desired effect.

President Roosevelt has signified his purpose to attend the Eleventh International Railroad Conference of the Young Men's Christian Associations at Topeka, Kan., April 30-May 3. The President's well-known interest in railroad men has undoubtedly influenced him to accept the invitation to meet this body of men who represent the vigorous type of manhood which he admires. Among the speakers secured in addition to the President are: Dr. Elmore Harris, Dr. P. S. Henson, President Ramsey, of the Wabash; Governor Bailey, of Kansas; General Manager Mudge, of the Santa Fé, and Rev. Chas. M. Sheldon. Col. John J. McCook will be the presiding officer.

The Union Pacific have issued a very handsome scenic guide book called "Across the Continent," which illustrates an overland trip from the Missouri River to the North Pacific Coast, via the Union Pacific, the Oregon Short Line, and the Oregon Railroad and Navigation Company's lines. Numerous illustrations of the principal buildings of the important cities passed through on the trip are shown, and many of the natural wonders of the country are reproduced in full page half-tones which have all the detail of good photographs. The book is really a reference album of the country. Two views of the famous Shoshone Falls, on the Snake River, Idaho, are worthy of mention. This river descends 500 feet in four miles in this vicinity, the actual fall itself being 225 feet in one leap. "All about is volcanic-rock, wild lava fields and desolation." The Giant Geyser, in the Yellowstone National Park, closes the interesting series. This book may be had on application to the company.

The Pressed Steel Car Company, of Pittsburgh, Pa., have issued a statement to the stockholders signed by the auditor, from which it appears that the surplus earnings for the year 1902 reached the extraordinary figure of $3,403,114. The Pressed Steel Car Company is evidently enjoying prosperous times.

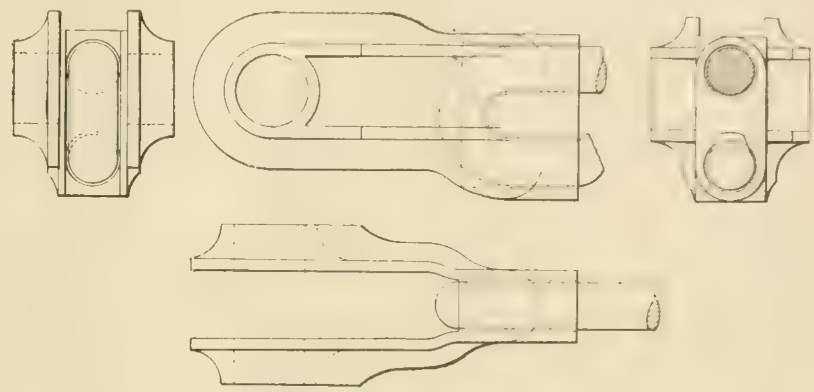


FIG. 1. NATIONAL BRAKE JAW.

The Pratt & Whitney Company, of Hartford, Conn., have issued a folder in which they show a picture of the building which they have just added to their small tool department. This addition they say fully doubles their capacity, as the plant is thoroughly equipped throughout. They make in this department taps, reamers, ratchet drills, milling cutters, punches and dies, Echols' patent taps, with interrupted threads, suitable for tough steel, copper, etc. They make gauges of all kinds.

A favorite pastime of transcontinental travelers is counting the number of telegraph poles in a mile, and then figuring on how many seconds ought to be consumed between telegraph poles to represent a given speed. On the Lackawanna and on the Nickel Plate there are 40 telegraph poles to the mile. Some of the Western lines use 25.

Australia's Climbing Frogs.

It is said that one of the great enemies of the overland telegraph line in Central Australia is the common green frog. In order to save the insulators from being broken by the lightning they are provided with wire "droppers" leading round them at a little distance to conduct on to the iron pole in case of need. The frogs climb the poles and find the insulators cool and pleasant to their bodies, and fancy that the "dropper" is put there to furnish them with a back seat. After a nap they yawn and stretch out a leg until it touches the pole—result, sudden death to the frog, and as the body continues to conduct the current to earth, we have a paragraph in the papers to the effect that "in consequence of an interruption to the lines probably caused by a cyclonic disturbance in the interior, we are unable to present our readers with the usual cables from England."—*Argonaut.*

The Stannard & White Company, of Racine Junction, Wis., make camp cots for the United States Army, and they look to be very comfortable. We mean the cots look comfortable, though as we wrote it down we certainly said the army looked comfortable, which they no doubt are, having these cots. This firm now makes twenty different styles and sizes of locomotive cab seats, so that "all sorts and conditions of men" may be accommodated, and all sorts of cabs may be suited, and we have no doubt that the users of these seats will not only look comfortable, but will be comfortable. The company will be very pleased to send catalogue and full particulars to any one who writes them to do so.

It will be remembered that the locomotive engineers of the Erie Railroad built an engine for the exhibition at the Columbian Exhibition at Chicago, held in 1893. It was supposed to be the embodiment of practical locomotive design from the runners' standpoint. This engine was subsequently bought by the Erie, and it is said, will be put in service between Jersey City and Nyack hauling a local train.

"California in a Tourist Sleeper" is the title of a booklet published by the Santa Fé. It is quaintly illustrated with pen sketches printed in dull red and half-tones showing comforts of the tourist sleeper. The chapters are only a page long and there are only eight of them. A time table and tariff of berth rates are given, together with a list of the company's agents and a map of the road. A copy will be sent on application to the company. We may mention that the New York office is at 377 Broadway.

A press report says that one man was killed and another severely scalded as the result of blowing out four plugs in the cylinder of a freight engine on the New York, New Haven and Hartford Railroad. We suspect that instead of cylinder plugs they were plugs in the boiler-head that close up the openings of the tubes supporting the brick arch.

The Norton patent ball-bearing jacks and the "sure drop" track jacks, manufactured by A. O. Norton, of 286 Congress street, Boston, are listed in the 1903 catalogue, just issued. All sizes and all kinds of Norton jacks are represented there. A picture showing four men tugging at the jack bars of two old-fashioned bottle jacks raising a box car is humorously contrasted with two men using two of the Norton car jacks to do the same work. These men are each only using one hand, and they look happy, thus is comment rendered superfluous. Among the jacks shown are those of the traversing kind with steel base, jacks for general purposes, those with hook for ground lift and handy little car inspectors' or journal jacks, track jacks, etc. The catalogue will be sent to those interested if they will apply to Mr. Norton.

Shakespeare talks of something that "murders sleep," yet the great dramatist never heard the discordant noise made by the porter pushing up the upper berth of a sleeping car. The sound assassinates every vestige of repose remaining in the brain of a weary traveler.

Jenkins Brothers' catalogue for 1903 shows that they have establishments in New York, Boston, Philadelphia, Chicago, and London. The catalogue is profusely illustrated with engravings showing every description of valve made. —Graber water gauge, gauge cocks, injectors, pump valves, Jenkins' standard '96 packing, gaskets, gasket-tubing, valve stem packing, union rings, water-cock washers, steam traps, valve files, pipe hangers, and, in fact, everything connected with pipes and pipe work, boiler attachments, etc. The firm will be happy to forward copy of the catalogue to anyone who is interested enough to apply. The address of their New York establishment is 71 John Street.

The Philadelphia Pneumatic Tool Company reports that its sales for December exceeded those of any other month but one in its history, and a number of large orders for pneumatic tools which had been held over until after the first of the year have already been received and executed by this company. A feature of

the Philadelphia Company's business, which they speak of as being very gratifying to them, is the large increase in railroad trade during the last six months of 1902, not only in the United States, but in Canada and Mexico.

We are informed that this company has arranged to double the size of its offices in New York by renting additional room in the Singer Building, corner of Broadway and Liberty streets. This is made necessary by the increasing business in and around New York city. An electrically driven air compressor and a complete plant for testing and exhibiting pneumatic tools of all kinds, in operation, will be installed. The New York offices will continue under the management of Mr. W. A. Battey, assisted by Mr. James H. Beaubien. Orders have been recently received by the Philadelphia Pneumatic Tool Company for complete equipments of pneumatic tools for the National Railroad of Mexico and for the Interoceanic Railroad of Mexico.

We are informed that it is the policy of the United States Steel Corporation to keep the price of steel rails within moderate limit. Their sense of moderation was lately displayed in raising the price from $28 to $28.50 a ton. As it costs about $14 to produce a ton, the humor of the Steel Trust's sense of moderation will be appreciated.

Passengers who travel from Chicago to California by the magnificent Santa Fé limited speak enthusiastically about the electric lighting of the cars by the Consolidated Railway Electric Lighting and Equipment Company's system. The difficulties which were encountered when the system was first introduced have been entirely overcome, and the lights are just as reliable as those of an ordinary dwelling. Quite a number of private cars belonging to Santa Fé officials have had this system of lighting installed, which is an excellent testimony to the merits of the system.

The Crosby Steam Gauge and Valve Company, of Boston, Mass., have issued a folder in which the Crosby spring-seat valve is explained by cut and letter press. The novelty in this valve is that a section of the face and seat is conical like the letter A, which is said to give a double seating capacity which prevents leaking. A small groove cut in the apex of the cone permits of a springing action, but prevents any jambing when the valve is closed, and this arrangement is useful in allowing for any variation of temperature. The working parts of the valve having been made by special machinery, are interchangeable and easily removable. The Crosby Company will be happy to give particulars of this valve to any one who will write them on the subject.

Explosions of locomotive boilers are becoming painfully numerous. During the month of January we were informed of about five explosions which resulted in loss of life. The principal cause seems to be broken staybolts. Broken staybolts are much more dangerous in a boiler carrying a pressure of 200 pounds to the square inch than it is to a boiler carrying 140 pounds gauge pressure.

Great Britain's Locomotives is the title of a portfolio which has been issued by the *Locomotive Magazine* of London. There are in this convenient little linen-covered case, twelve colored plates about 11x12 inches, showing engines on the leading English lines. There is also enclosed a list of F. Moore's railway photographs and lantern slides. The colored plates may be had at the office of RAILWAY AND LOCOMOTIVE ENGINEERING for 15 cents each or $1.00 for the complete portfolio.

The world's longest tunnels are the New York Rapid Transit, 32 miles; Metropolitan, London, 13 miles; Simplon, Switzerland, 12 miles; St. Gothard's, Switzerland, 9 1-4 miles; Paris Underground Railway, 8 1-2 miles, and Mount Cenis, Switzerland, 7 1-2 miles.—*Queensland Railway Times.*

"Hard Water Made Soft" is the title of a little pamphlet got out by the Industrial Water Company, of 126 Liberty street, New York. The pamphlet deals with that company's method of water softening and purifying apparatus. Therein it is pointed out that no one process in the world is exactly suited to more than one particular kind of water. The company states that they can extract oil from the water of condensation, soften hard water, clean muddy or swamp water and purify water which contains acid. There does not appear to be any hidden process involved, as the company say they simply supply the machine and allow the purchaser to buy soda ash and quicklime in order to carry on the work. The pamphlet will be sent to those who ask or write to the company for a copy.

The Bible and the Empire State Express.

A Bible student has recently been figuring on how long it would have taken the people to make the journey from Dan to Beersheba if they could have had the benefit in the olden times of the Empire State Express. He figured that the train would have made this journey in less than three hours, although from a read-

ing of the account in the Bible one would think it was a long journey, and it was for those days with their limited means of transportation. Ezekiel, the Chaldean prophet, had in his mind's eye something like the Empire State Express when he uttered the words recorded in the first chapter of his prophecy. Look this up and see if you do not agree with the idea.—*From the Troy Daily Times.*

The C. W. Hunt Company, of 45 Broadway, New York, have their works and office on Staten Island. They have recently got out a little publication which they call Pamphlet No. 031. It gives some applications of "Industrial" Railways, particularly the use of such a railway in the boiler room. Several half-tones illustrate the matter and are accompanied with explanatory reading matter. Among other things the views show the industrial railway in the Brooklyn water works, the G. W. Wheelwright Company's plant, the Stanley Rule and Level Company boiler room, etc. The back shows standard track and all sorts of cars, trucks, buckets, hoppers, ladels, etc., made for all sorts of uses. Write the Hunt Company for catalogue or full particulars if you are interested.

The Pullman Palace Car Company have arranged to reduce the working hours in their shops from 60 to 54 hours a week, making a nine-hour day. The reduction of working hours affects about 8,000 men.

The Anaconda Copper Mining Company is about to put in operation a new 5,000-ton-per-day reduction plant, which will be equipped with electrical apparatus for power distribution. A recent contract with the Westinghouse Electric & Manufacturing Co. embraces seven motors of an aggregate of 185 horse power, to be added to the present installation of about 30 Westinghouse motors of an aggregate of over 1,000 horse power.

The Baldwin Record of Recent Construction No. 40 is an illustrated reprint of the paper read by Mr. W. J. McCarroll, before the Traveling Engineers' Association, 1902. It is on the "proper handling of compound locomotives." Illustrations of the different positions of valves and pistons of the Vauclain compound are shown, the flow of high and low pressure steam being represented by colored engravings. It contains about 13 pages of reading matter and is uniform with the series which the Baldwin people issue from time to time. The booklet is useful for instruction and reference. Application to the Baldwin Works, Philadelphia, is the way to get a copy.

The Allis-Chalmers Company, of Chicago, have taken a very appropriate way of commemorating the opening of their West Allis foundry, which occurred in the latter months of 1902. This well-known concern, which among other specialties makes the Gates rock crusher, or what we may call a railway ballast producer, is distributing among friends a very handy paper weight in the form of a little flat, hollow brick. It is composed of bronze poured from the first heat run in the West Allis shops. There are two stamped medallions let into the weight, one showing a perspective view of the works and the other a likeness of Mr. Edwin Reynolds, chief engineer, who designed the plant. The paper weight is nickel plated and has two convenient grooves for finger and thumb, so that it may be readily picked up. It will be found a very useful and handsome addition to the desk "furniture" of the company's patrons and may be had on application.

It is reported that the New York Central has arranged for the services of sixty surgeons who will live along the line and be easily got at all the time. Each physician will have charge of a certain allotted length of line, and trains will carry emergency cases and some requisite surgical appliances.

At a recent meeting of the Board of Directors of the Seamless Steel Tube Company, of Detroit, Mich., Mr. W. C. McMillan was re-elected president, Mr. T. H. Simpson vice-president, Mr. George M. Black secretary and treasurer, Mr. R. H. Phillips assistant secretary, and Mr. C. H. Wood manager.

The steel mills at Homestead, Pa., by the employment of 4,000 men and highly perfected machinery, produce as much steel as 15,000 men do in the Krupp works, with crude machinery. That is why steel can be made in America at less cost than it can be made in any other country.

It is stated in a press dispatch from London that the amount awarded to the Taff-Vale Railway by the Court of King's Bench is $115,000. The money will have to be paid by the Amalgamated Society of Railway Servants.

The draughting rooms of the engineering department, Pennsylvania Railroad, in the Union Station, Pittsburg, have recently been fitter throughout with the Nernst lamp. The quality of this illuminant is peculiarly suited to the requirements of draughtsmen, having a perfect downward distribution of light, of daylight quality, with an absence of shadow or flicker.

Railway and Locomotive Engineering

A Practical Journal of Railway Motive Power and Rolling Stock

Vol. XVI. 174 Broadway, New York, May, 1903 No. 5

ON COLORADO SPRINGS AND CRIPPLE CREEK RAILWAY.

Gold Fields Scenic Railway.

The engraving shown is made from a photograph of a scene on the Colorado Springs & Cripple Creek District Railway, which is famous for its magnificent scenery. The ride of forty-five miles from Colorado Springs to Cripple Creek District is one panorama of Nature's most gorgeous mountain and canon scenery. The road is worthy of the rich scenic and mineral attractions to which it leads. The roadbed is of an ideal character, the track is made up of 75-pound steel laid on broad ties as numerous as could be put in, ballasted with disintegrated granite. The vice-president, Mr. William Lennox, an Iowa man, is exceedingly proud of the road, and he has good cause for being so. Mr. Lennox left a farm in Iowa thirty years ago to seek health in Colorado, and, like many others with the farmer training, he found both health and fortune. Few men have been more deserving of both blessings.

The "Third Man" on an Engine.

There is at the present time an agitation in favor of seeking legislative enactment which will compel railroad companies to place a special lookout man on every engine, in addition to the regular engineer and fireman. This agitation is no doubt the natural result of the recent terrible railroad accidents, particularly the one on the tracks of the Central Railroad of New Jersey, in which, it is said, a caution and a stop signal were both disregarded. The fact that such a law, if passed, would entail additional expense on railroad companies may possibly make it even more attractive in the eyes of a certain section of the community. It is well, however, before any such regulation receive government sanction, to consider the question from all sides.

The public desires to have something done to prevent danger signals being passed, but it is by no means certain that three men on an engine would be the cure all, which many are disposed to assert. We believe that the automatic stop signal will come in time, for use on crowded roads or where the fullest track capacity is required, just as the high-speed brake came in due time for very fast trains which required maximum stopping power, but in the meantime would the "third man" give the security desired?

In the first place, an engineer and a lookout man on an engine would divide responsibility, and in times of emergency it is quite conceivable that they might misunderstand each other. There is also the question of rank involved. One of the men would be practically subordinate to the other, even if the rule which placed the third man on the engine gave him equality of rank. The practical result would be that either the engineer would be really in charge of the engine or the lookout man would be in charge, and whoever was not in charge would occupy a more or less advisory position. Two men cannot run one engine satisfactorily at the same time. There is also the liability that two men who would have to sit on the same side of the engine might discuss the latest shop news. In fact, the same objection to the "third man" can be urged as is now assigned for keeping passengers and others out of the cab altogether—the presence of some one else tends to distract the attention of the man doing responsible work.

Examples are not wanting in which accidents have occurred with extra men on an engine. A collision took place at Mud River, Pa., in 1888 in which 66 persons lost their lives, and at the time there was a pilot with the engineer in the cab. In a collision at Monmouth, Ill., some years ago, a passenger train was wrecked by running over a misplaced switch, with engineer and road foreman of engines in the cab at the time. There have been serious accidents to double-header trains due to the runner of each engine not acting in unison, or viewing circumstances differently when there is no time or opportunity for consultation or explanation. It is open to grave question whether in thus seeking to divide responsibility for clear definite action in cab, those favoring the "third man" may not in reality be increasing the fallible "human element" in the problem.

A Train Is Harder to Push Than to Pull.

A walking stick on end successfully balanced on the finger, is a difficult feat, for the reason that the base of support has to be constantly moved in order to keep it approximately under the shifting center of gravity. This illustration is, in a way, analogous to what an engines tries to do when it backs a train of cars along the track. If one tries to push a cart along the roadway one will find that it takes a lot of steering to do it. In the case of railway cars there can be no such intelligent steering, as the push is only delivered through the coupling, and as this cannot be moved to the right or left, it happens that the necessary "steering" has to be done by the rails, with additional flange friction. If the balancing of one stick on the finger be a difficult task, the balancing of a second on top of the first would be still more difficult, and when the analogy is applied to the case of a long train, it is easy to see that in order to keep the backing train straight without the aid of the track and flange friction the engine would have to do such an amount of "steering" as would be quite out of keeping with its dignity as a steady-going locomotive in good standing. It is easy to draw a chain straight along the ground over obstacles if need be, but it would take a considerable expenditure of power to push even a short chain between the flanges of a steel channel, supposing the chain fitted easily in the steel shape and even if both were well lubricated. This reason why a train backs harder than it pulls will furnish an additional cause for the slipping of an engine while backing, which has already been explained by J. A. B. on page 181 of our April issue. The transfer of weight from drivers to engine truck and the large increase in flange friction, both of which come into play when an engine backs up, combine to make the work of pushing very much harder for the engine than the work of pulling the same train over the same piece of level track.

Devouring Mileage.

An amusing story in which a vaudeville actor, a goat, a railway ticket and a genial passenger agent figure, has found its way into the public prints. The points are briefly that the vaudeville actor in question has two performing goats, who, when before the footlights, entertain the audience by eating what purports to be some of Uncle Sam's currency, whereupon the actor feigns despair at the untimely disappearance of his hard-earned wealth. The other day one of these goats gave a full-dress rehearsal at the railway station in Detroit. Just as the actor handed his ticket (good from that city to New York) to the baggage man at Detroit, the animal made a grab for it, and before anything could be done, began to eat the ticket. The actor's despair was quite real this time, but the goat naturally regarded it quite professionally, and chewed up the Detroit-Buffalo coupon, and was rather disappointed at not receiving a round of applause. The mutilated ticket having the marks of Billy's teeth in it, together with a full explanation, was duly sent to Mr. O. W. Ruggles, the general passenger agent of the Michigan Central, who generously issued another, and let us hope goat-proof, ticket to the vaudeville actor. The goat, it appears, intended to have eaten the entire ticket, but was almost choked by his erstwhile friend before he got all the mileage in, and had it controlled by one head. It is rumored that the goat intends starring it alone next season in the rôle of a "railway merger," if the Northern Securities decision does not stand in the way.

New Book.

Dies. Their Construction and Use, by Joseph V. Woodworth. Publishers. Norman W. Henley & Company, New York, 1903. Price, $3.00.

This book has 384 pages and 505 illustrations, and is divided into twelve chapters. It contains also a good index. It is a treatise upon the designing, construction and use of tools, fixtures and devices, also on the manner in which they should be used in cheap and rapid production of sheet steel articles and parts. Dies, press fixtures and sheet-metal working devices are described by the author from the simplest form up to the most complicated, in a clear and practical manner, which is easily understood. In fact the book was written by a practical man for practical men, and is one which will be of value to die makers, machinists, tool-makers, metal-working mechanics and others interested in the subject.

The exhaust steam from the stationary engines driving the machinery in the Southern Pacific shops at Oakland, Cal., is condensed and the water produced, is used for washing out and filling the locomotive boilers. The effect on the boilers is excellent.

Different Effects with Oil Burning.

We hereby publish two engravings to illustrate the different appearance that results from burning oil as fuel due to the skill or otherwise of the fireman. The first picture shows two antiquated locomotives whose boilers are used to generate the steam necessary for driving the machinery of the Santa Fé shops at The Needles, Cal. They are working at their highest capacity, but not a breath of smoke is to be seen. The fireman who is seen leaning out of the cab is a Mojave Indian, from which it may be inferred that high-class labor is not necessary to burn oil successfully in a stationary plant. The men standing around are mostly officials belonging to the road, among whom we recognize Mr. H. Schaefer, master mechanic.

POWER PLANT BURNING OIL.

The other is a traction engine also using oil. It is needless to say that there is considerable smoke in evidence. They used to burn straw in the boilers of these engines, and ideas of fuel economy were not developed. They are burning the oil as recklessly as they burned straw. The country around is so vast that there is no fear of making a smoke nuisance annoying to human beings. Locomotives burning oil sometimes create great volumes of smoke, but they are generally quite clean, depending upon the condition of the engine and the skill of the fireman. We will, however, have a good deal to say about this in future issues.

Melted the Grate Bars.

The death of Mr. James Wood, the veteran locomotive engineer on the New York Central, removes a well known and interesting figure from the railroad world. Interest in the early days of locomotive running has been revived by Mr. F. H. Pulsifer, who has given some interesting facts to the Rochester *Herald* stating that Wood was the first engineer to burn coal, i.e. hard coal, in the firebox of an engine. He says that early in the fifties he, as a boy, often took trips on the engine run by Mr. Wood. In describing the occurrence he says:

"My father, the first dealer in coal at Auburn at that time, was agent for the Scranton mines.

"The train I was on being at Cayuga beside a train of coal cars, of the kind emptied by tipping to one side, I suggested to Mr. Wood that possibly some of our coal would make a good locomotive fuel, and offered the use of a supply from my father's cars, wherefore he had the fireman put a good quantity in the tender and then being well fired up with wood, filled up the furnace with Scranton coal.

"I shall never forget the expression which passed over his face, as he opened the fire door when we were running over to Owasco Bridge. So hot was our fire that the grate bars, which had melted, dropped out with the fuel and ash pan into the stream and 'Jim' looked through the furnace door down to the river below.

"Soon after the 'Providence' received a new set of grate bars and ash pan, but for many years no one else knew just what happened to us."

A novel and interesting way of advertising has been hit upon by the Grand Trunk Railway. It is the giving of an exhibition of moving pictures from scenes along the line. Among those recently shown were a trip over the Victoria Bridge and through the St. Clair Tunnel and some trout fishing scenes in Muskoka.

In the exhaustless catalogue of Heaven's mercies to mankind, the power we have of finding some germs of comfort in the hardest trials must ever occupy the foremost place.—*Barnaby Rudge.*

THRESHING ENGINE BURNING OIL.

The Tandem Compound Locomotive.

F. P. ROESCH.

Among the various types of compound locomotives in operation in the United States, there is one type which, where understood, is rapidly forging to the front, due to their excellent work, good riding qualities, low fuel consumption, and where men are educated in locating the few steam blows, these engines are subject to, to their comparatively low cost for repairs and maintenance. We refer to the American Locomotive Company's type of tandem compound.

These engines are of the four-cylinder, continuous-expansion type, but, unlike most four cylinder locomotives, the cylinders are coupled in tandem, that is, the high-pressure cylinder is coupled ahead of the low pressure, both pistons in each side being mounted on the same piston rod; the steam chests for each cylinder are joined together, making one continuous steam chest in which both valves—usually of the piston type—operate, both valves being on the same valve rod and operated same as a simple engine.

Both pistons being mounted on one piston rod, these engines are not subject to the twisting strains on the cross-head developed in other four-cylinder compounds, and therefore a lighter cross-head can be used, and consequently are easier counter-balanced, thereby improving their riding qualities, and also eliminating the piston rod packing blows, so frequently found in other types. Both cylinders are also fitted with an excellent system of by-pass valves which materially aid their drifting qualities, the writer having maintained a speed of fifty miles per hour drifting, with a consolidation engine of this type, weighing 175,000 pounds on drivers, with 57-inch wheel.

The starting valve is of very simple construction, consisting of a plain casting containing two ports connecting the two steam ports of the high-pressure cylinder, the steam connection being made by means of a straight plug mounted on starting valve rod and operated to admit high pressure steam to low-pressure cylinder at will. There is nothing about this device to leak or get out of order, which is quite an advantage.

In a series of extended road tests conducted by the writer with this type of locomotive in comparison with simple engines developing practically the same tractive power and having the same weight on drivers, the tandem showed an economy in fuel, figured on a ton mile per hour basis, of 34 per cent. on 1 per cent. grade and 37 per cent. on 1½ per cent. grade.

Part of this economy must be attributed, however, to the difference in grate area in favor of the compounds, they having the wide fire box, while the simple engines in comparative tests were fitted with narrow fire boxes. The difference due to the increased grate area, figured on an evaporative basis, was calculated by the writer to be equal to 13 per cent., which leaves the gain due to compounding 21 and 24 per cent., respectively, according to grade. It having been found that with full tonnage, or, in other words, at slow speeds, the compounds showed a greater efficiency over the simple engines than with light tonnage or at high speeds.

It is not the purpose of this article, however, to lead anyone to believe that in the tandem compound locomotive the acme of perfection in compound locomotives has been reached. The tandem has its faults, the same as any other locomotive, the principal one being due to the vibrating sleeve, packing the piston between the high and low pressure cylinders. This sleeve being enclosed between the two piston heads is rather hard to get at, and also difficult to lubricate, consequently where the lubrication is not well looked after, the sleeve wears very fast and often seriously impairs the efficiency of the engine. This defect and other steam blows, which occasionally develop, seem, to the average engineer, rather hard to locate unless he has been carefully instructed in their location, and also in the construction of the valves and cylinders and the manner in which steam passes from one cylinder to the other and through the various ports. We will therefore treat of this part of the tandem compound locomotive in a separate article under the head of Diseases of the Tandem Compound, a careful study of which article should enable any engineer to readily locate any steam blow which may develop, and so save quite a little expense to the companies where these locomotives are operated, by his knowing how to report all defects correctly.

The Automatic Block Signal in England.

One of the reasons why the automatic block signal, such as is used in the United States is not universally applicable to British railway lines is said to be that they are not very satisfactory at junctions, and there are almost innumerable junctions on these lines. Since 1902, however, some progress has been made in the introduction of this kind of train signal in the British Isles.

The London and South-Western Railway has installed a series of such signals controlling five blocks between Andover and Grately, and have been so much pleased with the result that they intend to extend the system to their four-track road between Basingstoke and Woking, a distance of about twenty-four miles. This line has adopted the low pressure pneumatic electric system, which is made by the British Pneumatic Signaling Company, which has recently amalgamated with the well-known English firm of Saxby & Farmer. The Great Eastern is also contemplating a trial of the automatic block signal.

The Great Central Railway Company are using the Miller system experimentally on a section near their Woodhead tunnel. The tunnel is three miles long and forms one block, which causes much delay to traffic. This system will enable the length of blocks to be shortened and does away with the necessity of signal men being placed in the tunnel. The Miller system is expected also by South-Western officials to very successfully solve the problem of train movement in foggy weather.

The North-Eastern Railway are experimenting upon a section of line eleven miles long between Alue and Thirsk with the Hall electro-gas system. Electricity is the controlling agent, but the motive power is compressed carbonic acid gas contained in cylinders very like those which are used in soda water fountains. Each cylinder is capable of giving about 6,000 signal movements. This system is now being installed on the Paris, Lyons and Mediterranean, and Midi lines in France.

No More Broken Platform Sills.

The Central Railroad of New Jersey people are now doing away with the flimsy plate which is usually fastened by unreliable wood screws to the platform end sill of passenger cars, where the shank of the Miller buffer comes through. The practice adopted at the Elizabethport Shops is to remove this plate and replace it by a 7-inch channel (each of which is supplied in specified lengths by the steel mills). These channels have the holes for the buffer shank punched out in the bull-dozer, and the bolt holes at the ends punched out in the usual way. The application of these steel channels, of about 33 inches in length, very materially strengthens the platform-end sills by distributing any strain which falls upon them to four platform timbers. The presence of two substantial bolts in the place of a few wood screws driven in by a screw-driver and oftener by a hammer, is a very great improvement. The life of the platform-end sill is very materially lengthened. The riveting over of the bolt ends prevents the channel from ever working loose. The material of which it is composed, and its shape, is a guarantee against cracking, and not only is the arrangement more durable, more easily applied, more in accordance with correct mechanical principles, but it

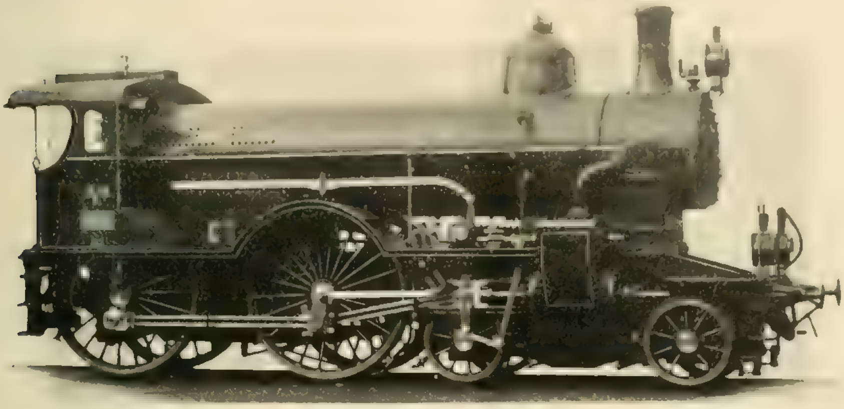
looks far better than the old plate, which invariably came into the repair shop with screws missing, timber broken and a general air of "couldn't stand the racket" on the road. The new plan is good and it looks well.

European Notes.

The Mersey Railway, which connects Liverpool and Birkenhead by means of a tunnel under the river Mersey, has for a period of seventeen years been worked by steam locomotives, but for many reasons, not excluding the foul condition of the tunnel, and the desire to provide a quicker and more frequent service of trains, it was decided to electrify the road and to adopt the new method of hauling the trains now in operation. The line has its terminus at the Central Station, Liverpool, on one side of the water, and on the other at Rock Ferry, its total length being a little over four miles; the gauge is, of course, standard. The work of conversion to the new traction was commenced in January, 1902, and despite the difficulties due to the heavy and continuous traffic running through the tunnel the work was so rapidly pushed forward that on March 1 last the line was ready for electric traction. The British Westinghouse Co. have carried out the work and the main generating engines and plant have been supplied from their East Pittsburg works. The steam locomotives which are now practically useless for the Mersey Company are eighteen in number and are of two distinct types; they were built by Messrs. Beyer Peacock & Co., of Manchester, and Messrs. Kitson & Co., of Leeds.

All the British locomotive builders will be fully employed on orders for some considerable time, many foreign railways having engines being constructed for them. The firms of Messrs. Sharp, Stewart & Co., Nelson Reid & Co., Dubs & Co., all of Glasgow, have amalgamated, the combine being known as the North British Locomotive Company. With the thoroughly up to date machinery possessed by these three builders and the efficient means of dealing with their products generally, a considerable increase in the output is anticipated, thus enabling them to deal with many orders now passed to foreign competitors.

The Austrian State Railways have recently been supplied with a new class of passenger locomotive of Herr R. von Golsdorf's design. These engines are two cylinder compounds and have four coupled drivers 2.14 meters diameter, cylinders H.P. 0.50 meters and L.P. 0.76 meters diameter, with a stroke of 0.68 meters. In general details the engines conform to recent practice of Herr Golsdorf and reference to the illustration herewith will show the Walschaert valve gear with the valves above, piston tail rods, extended smokebox, etc., etc. These engines weigh in running order 54,200 kilogrammes.



GOLSDORF COMPOUND—AUSTRIAN STATE RAILWAYS

The Great Northern Railway Company have built at the Doncaster shops an enlarged "990" Atlantic type passenger engine. The most important increase is in the large boiler, the diameter of which is 66 in., being the largest in the British Isles. The frames, wheels, cylinders, motion, etc., remain the same as the previous ten-wheelers. The firebox is constructed after the Wooten type and has a grate area of 30.9 sq. ft.; the total heating surface is 2,500 sq. ft. The first engine of this class is at present running on the East Coast expresses between Doncaster and Peterboro', and is giving great satisfaction.

The Great Northern have also in preparation a powerful new type of tank engine for the suburban traffic and the London, Brighton and South Coast Railway people are premeditating the building of some very large express locomotives.

The strike that occurred on the Taff Vale Railway and which resulted in the Amalgamated Society of Railway Servants being sued for aiding the company's employees in breaking their contracts and causing considerable public inconvenience, has after many legal decisions been settled by agreement and payment of £23,000 ($115,000) as damages. It is but fair to state that the chief officials of the A. S. R. S. were adverse to the action taken by the local committee in South Wales in assisting the strike, and ought to have taken more drastic measures to have prevented it, for as might have been expected this result has been a fatal blow to the society.

At the meeting of the London and North-Western Railway Company the question of reform was brought to the front by some prominent men, supported by a very large contingent of stockholders. There can be no doubt that the management of the company is very unprogressive, and one item of reform suggested was the adoption of larger cars for mineral traffic. As a sequel a deputation of L. & N. W. R. officials left for the United States on the 25th of February to learn and profit by the methods adopted there. In this direction it is interesting to note that large freight cars are being largely adopted on several roads, the Caledonian Company among others having just placed an order with private British firms for 300 cars.

MIDLAND STANDARD SIX-COUPLED GOODS ENGINE

Twelve new locomotives have just been constructed by Messrs. Sharp, Stewart

& Co. for the Bengal Nagpur Railway of India. They are powrful machines with six coupled drivers 73½ in. diameter, and cylinders 21 in. diameter and 26 in. stroke. The boiler has a Belpaire firebox and total heating surface of 1831 sq. ft., the grate area being 32 sq. ft. As regards rolling stock the B. N. R. are probably the most progressive line in India and the new passenger engines emphasize the statement. All the modern improvements in locomotive detail have been introduced and the finish of the engines reflects great credit on the designer and builders.

The Midland Railway have departed from their standard six-coupled goods engines of Mr. Johnston's design, which have with the exception of a few minor details been used since 1875, and have recently built at Derby some locomotives with wheels and frames the same as before, but having boilers of much larger dimensions and similar to those of the latest Belpaire passenger engines. The safety valves are placed above the firebox—quite a novelty for Midland engines.

The Great Western Railway are fitting their latest type of Mogul goods engine with taper boilers, thus somewhat increasing the steam space. The new De Glehn compound for the G. W. R. mentioned as being under construction at Belfort, in France, will, with the exception of a few details, be precisely similar to the "2643" class now running on the Northern of France Railway between Calais, Paris and Lille.

Automatic pneumatic signaling appliances are meeting with more attention just now and several projected installations are talked of.

A Well Managed Tool Room.

One of the best-managed machine shop tool rooms that we have seen is in the shops of the Southern California Railway at San Bernardino, the details having been worked out by Mr. Werst, the general foreman. The place is run strictly on the ticket system with messengers to carry the tools. They have the tools grouped in kinds to facilitate selection. For instance, drills, reamers taps and everything relating to hole making are grouped together. The forgings ready to replace at shortest notice every tool in use. The orderliness of the place is worth to the company a good many dollars daily.

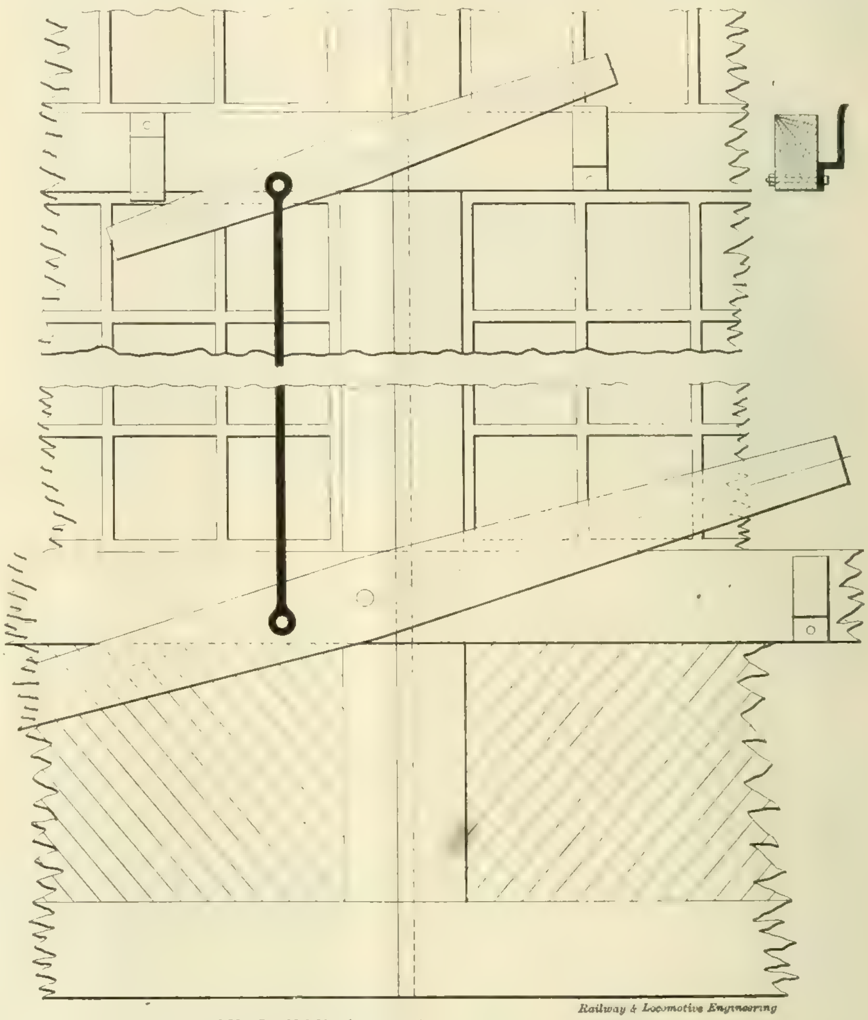
A small store department is run in connection with this tool room, all sorts of small pieces such as studs, nuts and bolts of the kinds most in demand. The time spent in going to a regular store house for a stud or such small article, is frequently more costly than the value of the article. The system of adhering rigidly to rules about drawing articles invariably from store rooms is frequently very costly, especially with the developed forms concerning orders that call for several entries of every article drawn out.

In this tool room they carry packing rings which rise in diameter by ⅛ inch from the smallest to the largest size. This insures having the size wanted, to a certainty. They carry about 500 rings in stock. The use of piston valves has greatly increased the demand for piston rings, and they are frequently wanted in a hurry.

There are reamers in the room increasing by 1-32 inch from 5-16 inch to 1¾ inch.

Round House Door Fastener.

A very easily made and very inexpensive door fastener is here illustrated. It is applicable to the doors of a round house or shop where engines or cars pass in or out. This door was originally made with a pivoted wooden cross beam which, when in position, engaged with two iron brackets appropriately placed, and so effectually braced the door. In order to prevent the gaping at the top which round house doors are prone to, a smaller and similar cross beam was pivoted to the upper cross rail of the door, at the same distance from the rabbitted edge of the door, and suitable iron brackets to receive its ends were bolted on. A few inches from the pivot points in these two cross beams two bolts were placed, one in each, and these were connected by a vertical rod. When it is desired to open the door the operator simply swings the lower cross beam into a nearly vertical position and the upper cross bar acts like the walking beam of a steamer, and swings "out of latch" and frees the upper part of door. In closing, the reverse operation is performed, and to make it always effective it is well to look to the form of the bracket which is attached to half door not carrying the cross beams. This bracket should be slightly bent outward at the top as shown in the section on the margin of our illustration, and should be made long enough to permit the small cross beam to engage with it even when the upper part of the door is considerably warped. This door fastener has been in use in a round house for many years in a region where very cold weather is experience in the winter, and the doors so secured are always snow-proof as far as the absence of the effects of warping or gaping are concerned.



ROUND HOUSE OR SHOP DOOR FASTENER.

Heavy 2-8-0 Engines for the Pennsylvania Lines.

The Pittsburg shop of the American Locomotive Company has recently delivered some heavy 280-193 type engines to the Pennsylvania lines west of Pittsburg. The engines are simple with 22x 28-inch cylinders. The driving wheels measure 56 inches in diameter outside the tires. The working pressure is 205 pounds, and the adhesive weight is about 173,000 pounds. The calculated tractive power is in the neighborhood of 42,000 pounds.

In looking at our illustration it will be seen that the engine has the second and the main driving tires without flanges. The rigid wheel base is 16 feet 6½ inches. The cross-head is of the two-guide bar type, the connecting rods only are of fluted section and the big end is of a design which is common enough in locomotive practice now-a-days, but which has something of the marine type about it. The driving wheels are all equalized together, the two leading pair have springs above the top frame bar, and the two rear drivers are equalized with springs placed between the upper and lower frame bars. The pistons drive on the third axle and the eccentrics, as is usual, are placed on this axle with a transmission bar made in two parts, which completely encloses the second axle. The valve motion is indirectly connected, and the valves are of the ordinary Richardson, balanced. It may be mentioned that the expansion links in these engines are suspended by two hangers, one on each side, there being two link-saddle pins provided. This arrangement, while not new, is a great improvement on the method of suspension from only one side, which while very successful on engines of smaller and lighter build, when applied to modern heavy machines, gives the link an opportunity to bind very badly and so seriously interfere with the operation of reversing. With the double hanger here used, the introduction of any measure of artificial lost motion as an expedient to prevent binding is not necessary.

The side rod is made with solid bushed brasses, and this form of construction is also followed with the crank pin of the forward driver, though the brass is secured to the rod with a strap bolted up solid to the rod end.

The boiler is of the wide firebox, extension wagon-top type, measuring 71 inches at the smoke-box end and 76 inches at the dome course. The firebox is of the Belpaire type and the crown sheet and roof sheet are quite level, though the back sheet slopes 20¾ inches at the top. The flues are 373 in number, 13 feet 8½ inches long, and contain 2,677 square feet out of a total of 2,842 square feet.

The tender has a deep-water bottom while the fuel space is arranged for the convenience of firemen. The tank holds 7,000 gallons, and the coal capacity is 13½ tons. The front of the water legs on each side is made in the form of a cupboard, so that no tool boxes show above the shallow coping. As the tender leaves the hands of the builder each is equipped with a tail rope slung alongside the steel channel tender frames. A few of the principal dimensions are as follows:

GENERAL DIMENSIONS.

Weight in working order, 193,500 lbs.; weight on drivers, 173,000 lbs.; weight engine and tender in working order, 336,500 lbs.; wheel base, driving, 16 ft. 6½ in.; wheel base, total, 24 ft. 9 in.; wheel base total, engine and tender, 58 ft. 1¼ in.

Cylinders, 22x28 in.; size of steam ports, 1½x 21 in.; size of exhaust ports, 3x21 in.; size of bridges, 1¼ in.

Valves, greatest travel of slide valves, 6 in.; outside lap of slide valves, 1 in.; inside lap of slide valves, 1/32 in.; lead of valves in full gear, 1/16 in.

Wheels, etc., driving box material, cast iron; diam. and length of driving journals, 9 in. diam.x13 in.; diam. and length of main crank pin journals, 6 in. dia.x7 in.; diam. and length of side rod crank pin journals M [illegible] in. F [illegible] & B 4½ in. dia.x [illegible] in.

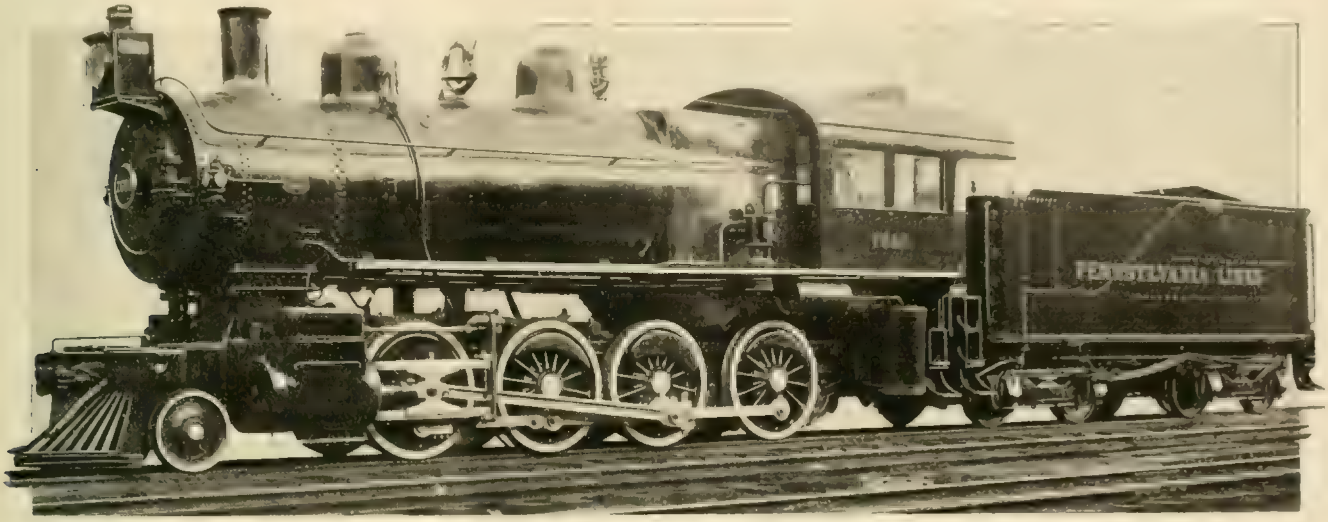
Boiler, working pressure, [illegible] lbs.; thickness of plates in barrel and outside of firebox [illegible], & 1⅛ in.; firebox, length, [illegible] in.; width, [illegible] in.; depth, front, 75 3/16 in.; back, 61 3/16 in.; plates, thickness, sides, 5/16 in.; back, 5/16 in.; crown, ⅜ in.; tube sheet, ½ in.; water space, front, 5 in.; sides, 5 in.; back, 5 in.; crown staying, 1 in. radial; stay bolts, ⅞ in. dia.

Tubes, material and gauge, No. 11 Charcoal Iron; number, 373; dia., 2 in.

Heating surface, tubes, [illegible] sq. ft.; firebox, [illegible] sq. ft.; total, 2,842 sq. ft.; grate surface, 49 sq. ft.

Smoke tack, top above rail; 15 ft.

Tender, weight, empty, 57,700 lbs.; wheels, dia., 36 in.; wheel base, 20 ft. [illegible] in.; trucks, pedestal type, with steel bolster; water capacity, 7,000 U. S. gallons; coal capacity, [illegible] tons.



HEAVY CONSOLIDATION FOR THE PENNSYLVANIA LINES WEST OF PITTSBURGH.

"Please Shut the Door."

We have recently come across a very ingenious way which a foreman of a large railroad shop has taken to always insure the fireproof door of his office being securely shut at night, which door is, as a lawyer might say, "for that purpose made and provided." The office contains records, etc., which are valuable, and at night the isolation of this room is important. There is a swing door made of wood with an elegant glass panel which shuts off the office from the shop, but this door has no lock. The fireproof door is the only one with a lock, so that in order to lock up the office securely the person charged with that duty is therefore compelled to combine with that operation the duty of closing the office against fire.

Stalled for Steam.

A train traveling on a small branch railway in the Highlands suddenly came to a standstill. One of the passengers poked his head out of the window to ascertain the cause, and just caught the guard as he passed under the window on his way to the engine. "Why are we stopping?" he inquired. "Hoot, mon, ye maun jus' abide a wee; the water's gane aff the boil."—*Tit-Bits.*

Belt Action and Heart Action.

"New Knowledge on Belt Management" is a book got out by the Cling-Surface Company of Buffalo. The company say, on page 13: "We return your money if you consider Cling-Surface not successful in your works," and the offer is couched in language which is refreshing to read, and, by the way, the book is free. Cling-Surface is said to cause a belt to cling so tenaciously to a pulley that the belt may be run absurdly slack. The half-tones in the book show loose, flapping belts transmitting high power. The company draws an analogy between a slack belt and heart action. We all know the heart rests between beats. "The working side of a belt is the beat, the slack return is the rest between beats." This rest they think prolongs the belt's life. They propose to make it very exceedingly busy when it does work, but with a pretty slack time for rest, while returning, between pulleys. The book itself has a sort of cling-surface, you can't lay it down until you get the drift of it, and, moreover, the book is free. Write for it and read for yourself. It is very interesting, and some things in it are new and strange.

Locomotive Smoke Stacks.

At first sight one might not suppose that the "draughting" of a locomotive had anything particular to do with the enjoyment, by the passengers, of the scenery along the railway line. It seems strange to say that a long or a short smokestack on an engine should make any difference to the traveling public, but some years ago the late locomotive superintendent of the Highland Railway in Scotland employed a unique arrangement in connection with the "chimneys" of his engines, which had for its object the comfort of passengers. The exhaust steam was thrown high in air, so that the beautiful views along the line of this celebrated railway were not hidden from the eyes of expectant tourist travelers.

The chimney used for many years on the Highland Railway is shown in Fig. 1, reproduced from the *Locomotive Magazine*, and the other cuts are from the same source. The chimney proper, or, as we would say, the smokestack, was surrounded by a casing which enclosed an air space. In the front part of this casing were a number of "louvre" openings like the sloping wooden slats in a belfry. These openings permitted the entrance of air as the engine rushed forward, and a strong upward draught of air between casing and chimney was thus secured, at the back, which had the effect of forcing the cloud of exhaust steam well up, so that it was completely dissipated before it could fall to the level of the coach windows.

The gradual increase in the size of locomotive boilers in Great Britain and the consequent reduction in the height of the chimney, as the "loading line" is approached, has produced a state of affairs hitherto unknown. The short-chimney engines trail their exhaust steam very much, along with what little smoke there may be, and it has the effect of handicapping the engine driver very seriously by obscuring his vision.

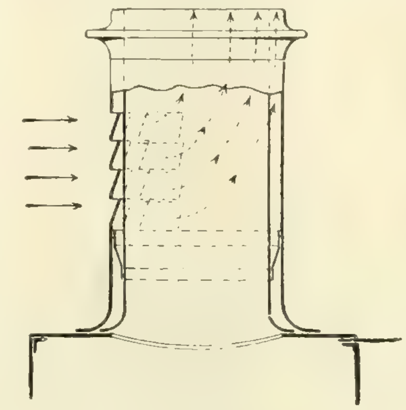


FIG. 1.

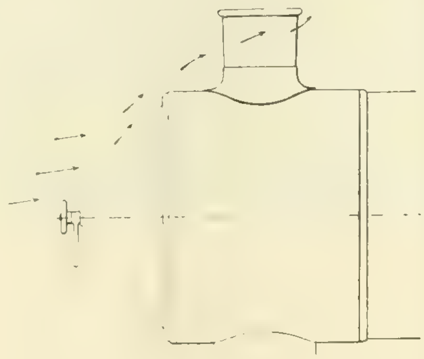


FIG. 2.

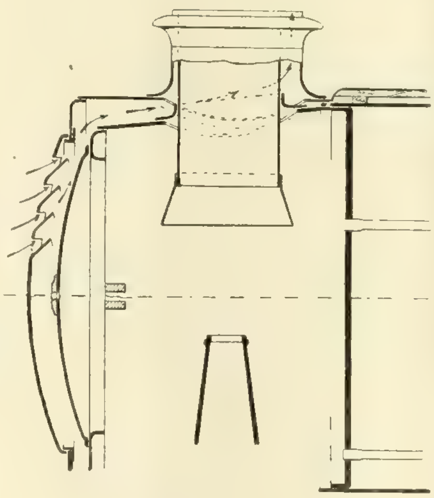


FIG. 3.

On many railways on the Continent a pointed form of smoke-box has been introduced where dwarf chimneys are used, such as is outlined in Fig. 2. This shows the diagonally upward movement of air currents caused by the motion of the engine. The use of this sharpened front end does not bring about the desired results when used with an extension smoke-box.

The advent of Mr. Holden's "Decapod" on the Great Eastern, which has a chimney just high enough to take a stand-up collar and a cravat, has no doubt suggested a modification of the Highland Railway chimney, so as to prevent the trailing of exhaust steam. The proposed plan is outlined in Fig. 3, and consists of a casing surrounding the front and top of the smoke-box, with "louvre" opening in the front upper half of the smoke-box casing. Air entering the space between casing and smoke-box is conducted to the back of the chimney, the true smokestack being placed well forward, somewhat out of center, and the result would probably be a powerful uprush of air just at the point where it would counteract any tendency to trail exhaust steam or smoke, and thus permit those on the engine to have a perfectly clear view of the signals and the track ahead.

Annealing Side Rods.

The Southern Pacific Company having suffered from an epidemic of broken side rods, the suggestion was made to anneal the rods, which has proved to be an effectual remedy. Mr. D. P. Kellogg, general foreman of the shops at Oakland, devised a furnace for the annealing, which does the work very effectually. It is a reverberatory firebrick furnace made long enough to hold the longest side rod. It is also used as a case hardening furnace, and the heat generated for that purpose is utilized for the annealing process.

The practice is to heat the furnace to the highest temperature for case hardening, then it is cleaned out and filled with side rods. No more heat is applied, the heat remaining in the brick being sufficient to thoroughly anneal the side rods. They remain in the furnace forty-eight hours and are then taken out. All strains of the original manufactures and those sustained in service are eliminated, and the rod is found to be stronger than it ever was. The epidemic of breakage has ceased.

An ordinance was introduced into the Chicago City Council some time ago establishing rules for the regulation of the smoke nuisance. Mayor Harrison was opposed to the ordinance, but it has been passed without his consent. There appears to be considerable politics in the move.

We understand that the Portuguese State railways, South and Southwestern, have just placed an order with Mr. A. Borsig, of Berlin, for four 6-coupled 4-cylinder compound locomotives with large double bogie tenders. Delivery has been promised for next autumn.

General Correspondence.

Old Time Railroad Reminiscences.

BY L. J. KIDDER.

It was about ten o'clock on a sultry July morning and the "Ananias Club" was holding an impromptu meeting on the shady side of the Ottumwa engine house, the four members present being seated on a divan, the constituent part of which was a three-inch plank attached to the exterior of the circular brick wall. One of the number had just related how many loads he had pulled up White Breast grade with the "Poweshiek," drawing on his imagination to make up the deficiency of power the engines should have possessed to make good the claim when one of his listeners exclaimed: "Hello! There comes a chap hunting for a railroad job, and I will bet the old man hires him." We all looked in the direction indicated and sure enough the young man referred to had all the marks of a successful aspirant, for we well knew the master mechanic's predilection for employing strong, healthy-looking country boys as the most promising material from which to make firemen and engineers.

The chap was plodding down the road, ycleped Main street, of Blake's addition, with a swinging, though uncertain gait, leaving a dense trail of dust behind, as his cumbersome cowhide boots ploughed through the deep, soft covering of that thoroughfare. Reaching the well-worn path leading across an open lot to the round house, he followed it and a moment later was in the presence of the club, one of which, in answer to the inquiry where he could find the man who hired firemen, directed him to the master mechanic's office.

The boy was, indeed, a promising subject for a fireman, being, perhaps, 19 years of age, of ruddy complexion, large head covered with an abundance of hair, a sort of cross between brindle and red, some six feet in height, stocky build and hands calloused to the extent that coal shovels and clinker bars would have little effect on them.

Entering the office he walked up to the picket fence which served as a dividing line between the M. M. and his caller, and doffing his hat inquired if they wanted to hire a man. The master mechanic turned about in his chair, took a long mental survey of the aspirant, and apparently a satisfactory one, then inquired his name.

"Tom Hayworth," he replied.

"Where do you live and what can you do?"

"I live at home over in Wapello township and have been working on a farm."

"What sort of job do you want?"

"Fireman."

"Did you ever fire coal any?"

"Well, no; I never worked on one of your railroad engines, but I fired a sawmill boiler with saw dust all last winter and I s'pose that's about the same thing?"

"Y-e-s," said the M. M. slowly in reply, causing a smile on the part of the official as well as the club members who had followed Tom into the office. After some further questioning, Tom's name was ordered placed on the list and be directed to come round at 7 the following morning ready for work.

The next day he reported promptly on time and was assigned to the clinker pit, where if the initial embarkation into railroad work was not quite up to his expectations, it certainly did afford an opportunity to demonstrate that he was all wool and a yard wide, so far as muscular activity and ability to weild a coal scoop was concerned.

Tom, called "Brick Top," for short, was soon promoted from the pit to the foot board where he manipulated the shovel for some two years, during which time he proved a good worker, though his ability as a fireman was of a somewhat mediocre character; but as time went by numerous promotions placed him at the head of the list of eligibles, and he was given the "Mahaska."

Long before he attained the right side of an engine, however, the hayseed had been eliminated from his hair, and a striking propensity developed by "Brick Top" was an insatiate appetite, not unlike the engine he fired, for fuel, and which, like the wart on his nose, was always with him. There was no eating houses along the road; as a consequence, lunch buckets had to be depended on, and as Tom's was not of sufficient capacity to provide for his demands, he depended upon those of engineers whom he chanced to meet along the road.

Every bucket that Tom could reach was stealthily robbed, did the owners happen to be oiling or away from his engine, and oftentimes insult was added to injury by "Brick Top," afterward complimenting his victim on the quantity and quality of the viands he had appropriated.

This state of affairs, like others of frequent repetition, finally became burdensome, and with a view of succor, an impromptu meeting was held by both club members and other freight engineers on the division, at which it was decided to take radical action, but what that should be was left for time and occasion to determine.

In these early days facilities for lodging at the West End were not very satisfactory and often unattainable; as a consequence, the engineers and firemen, all of whom lived in Ottumwa, slept on their engines when at the end of the division; the round house, too, being the only available place to pass the time while awaiting a return trip.

Several weeks elapsed before the opportunity presented itself to get even with "Brick Top;" but one Sunday morning, as several of us were passing the "Mahaska," the coveted occasion presented itself, and we were not slow in taking advantage of it. Most of us had had a full night's sleep, but Tom had arrived early in the morning and retired for a forenoon's nap on the seat box of the cab. For a mattress he had appropriated both the fireman's and his own cushion, one of which, as well as his feet, extended forward through the front door of the cab.

A fire-box door chain and two padlocks were hastily procured, one end of the chain being encircled about his ankles, the other round the side rod below, and both secured with the padlocks.

The conspirators then went up town to breakfast, returning an hour or so later finding "Brick Top" still wrapped in the arms of Morpheus, little dreaming (that is, we did not suppose he was dreaming) how long a time would elapse before he would again see his way clear to assuage his hunger. We brought up a bench, placing it near the driving wheels of an engine standing on a pit adjoining the "Mahaska;" and as we passed the forenoon in conversation, Tom lay there on his right side sweetly sleeping, his face in view just above the arm rest on the window sill.

Along toward noon he awoke, rolled over on his back, rubbed his eyes, then made a move to sit up, first endeavoring to draw his feet inside the cab; but they didn't draw. He then sized up the situation, and looking at his visitors laughed at the joke. Directly someone remarked it was time for dinner; then Tom endeavored to take a fresh survey of his attachments, but soon found he was a prisoner, for beside being chained to the side rod his corpulent body would not permit passage through the limited space afforded by the cab door. First he treated his incarceration in a jocular way, but soon discovered its import was of a character requiring more serious consideration.

Next he supplicated, interspersed with profuse promises to tamper with lunch buckets no more, and finally found vent

in expletives far more forcible than elegant, but all to no purpose. His tormentors went to dinner leaving two of their number on guard to prevent possible tampering with the padlocks, and Tom wrapped in meditation. Poor old "Brick Top" was kept in confinement until 7 P. M., when he was given his liberty, but too late for supper, as the hotels and boarding houses closed their diningroom doors at that hour.

The lesson proved a most salutary one, and while Tom threatened all kinds of vindictive things on the heads of the conspirators, nothing ever came; but from that time henceforth unprotected lunch buckets were as safe from being despoiled by Tom as he was from getting his meals that Sunday in Creston.

"Brick Top" is gone now, having passed from this vale several years ago, and the last time the writer heard his name brought up in a reminiscent way was when an old B. & M. engineer, who left the road during Tom's palmy days, inquired where he had gone, and one of the Ananias Club members replied, for once speaking the truth: "No one knows where Tom has gone; he's dead."

Piston vs. Slide Valves.

In the March number of RAILWAY AND LOCOMOTIVE ENGINEERING I read an article by Mr. Menzel, entitled "The Piston Valve of To-day," which certainly is a very good defense of the piston valve. In regard to being the most perfectly balanced valve of to-day no one will deny it. I do not see where it has all the virtues attributed by your correspondent. In the first place it is much more difficult to keep tight than the slide valve is, on account of the wear of the rings, and also on account of the wear the rings cause in the bushing when the engine is cutting off short. This in time leaves a shoulder in the bushing, which shoulder helps to shorten the life of the rings. Mr. Menzel also says that with the piston valve a direct motion can be used which gives a better distribution of steam and that the lead increases much more slowly when the engine is cutting off than it does with the indirect motion. In my experience with the valve motion of a locomotive, I have always found that the increase in lead from full valve travel to mid position was great or small according to the radius of the link, lead being increased much more rapidly with a short link radius than with a long one. There are, of course, other modifications that will control the lead increase, but I am speaking of the link motion as applied to the American locomotive. It therefore makes no difference whether the motion is direct or indirect as far as the lead is concerned, and as far as the distribution of steam by the valve is concerned the principle is the same with the piston valve as it is with the slide valve. From my experience with the piston valve on locomotives, aside from the fact of it being more perfectly balanced and therefore requiring less power to operate it, also its freedom from cutting the buildings, I do not see anything to recommend it in preference to the slide valve.

FRANTZ A. HURLBERT.
232 Dearborn Avenue, Chicago.

"A Machinist's Point of View."

Master mechanics and foremen in general have considerable fault to find with the inefficiency of machinists and their rambling dispositions.

Where there is "effect" there must be a "cause."

In the past few years there has been a tendency to run the majority of shops in a slipshod sort of a method. Engines have increased in size, and no effort has been made to facilitate the doing of the work. Consequently mechanics are compelled to do very heavy lifting, and meet with the disadvantage of doing the work without special tools which are necessary on the up-to-date engines. An effort on the part of the foremen to overcome these disadvantages would surely have a tendency to decrease the spirit of discontent and the number of time checks issued. In the selection of foremen master mechanics evince an inexplicable partiality for persons whose character embody little of the union principle and much that is disgustingly sycophantic. If the time ever comes when master mechanics and foremen receive their positions by the virtue of their ability as practical men, with a fair knowledge of the technical, then mechanics will have the incentive to reach the zenith of the trade.

A. ROYAL.
Alamogordo, N. M.

The "Third Man" on an Engine.

Of late there has been much talk of placing an additional man on locomotive engines when in service as a precaution against accidents due to the sudden disabling of one of the two men now on engines. Many ideas of all kinds have been suggested as to how to utilize this third man, and where to put him. These theorists lose sight of the old saw, "The child that many parents share, seldom knows a parent's care." In other words, divide the responsibility for performing any duty and it is a rare chance if that duty is not neglected in part, if not in whole.

Years ago when ships were 250 to 300 feet long, from taffrail to cutwater, the position of the wheel, by which the vessel was guided, was on the quarter-deck just abaft the mizzenmast. From this point the steersman had a clear view of the ocean ahead of him, when the foresail and mainsail were clewed up. When those sails were in use (set) there were lookouts in the waist and on cathead to warn the helmsman of any obstruction in his path; these men were not close enough together to hold conversation. The binnacle compass gave the helmsman his course. As ships increased in length the wheel, or bridge, was moved forward, until now on many ships it is forward of the foremast. This seems to be an evidence that nautical men discovered with the evolution of the ship that the man who controlled her movements needed, and should have, the best possible place from which to see how to do it.

The locomotive engine, after it came into use and had passed the experimental stage, was about 10 to 12 feet long from door of firebox to extreme of front end, and the engineer stood on a platform behind and alongside of the firebox, and had a clear and unobstructed view ahead of, and around, him. He could see over the dome of the boiler, and there was no forward dome, or big smokestack and headlamp to block his range of vision; the sandbox was low and was really no obstruction. Well, the locomotive began to increase in size and length until now many of them—a large majority—range from 30 to 40 feet from firedoor to extreme of front end. (By the way, did any one ever see the benefit of these "extension front ends," except the man who got a royalty for them?) On the great majority of the locomotives of the present day the engineer stands where he did sixty years ago, with to-day on his left side is a boiler as high as his head and on top of that boiler are usually two domes, a sandbox, smokestack and headlamp, which completely cuts off his view of the left hand rail for nearly a hundred feet from the front end. If he wants to see on a left hand curve he must open a side window of his cab and stretch out half his length to do so; this at the risk of being struck by some mailbag hanger or other obstruction.

To get back to the original proposition of an additional man on the locomotive, where is he to be put? With the present type of engines if he is put on the left side he can't see the engineer or communicate with him speedily. I believe some one has suggested electric signals or telephone. He can't be put on the engineer's side, for on many engines there is no room for a 200-lb. man to turn around. Granted, however, there is room, how long will it be before the two men get into an argument or a pleasant conversation, and then no one will be looking out? Mr. Editor, there is a remedy for this dilemma, simple and easy! Can't some of the inventors of the day find it?

E. J. RAUCH.

Licensing Enginemen.

The article in the March issue of Railway and Locomotive Engineering, touching upon the responsibility for boiler explosions, has brought out a suggestion from *Moderation* in the April number, to which I wish to make some objections. I disagree with him on two points, licensing of enginemen by State Board of Examiners and shifting responsibility for explosions on enginemen.

Who makes the time-card and forces men to make faster time? Is it not the transportation department? Who hounds the men to do better with inadequate power? Is it not an official? Who is responsible for the condition of the boiler and safety valves? Is it not an official in the mechanical department?

I should not call an engine a free steamer if I had to shut off the water to raise the steam to the point where the valves relieve themselves unless I had bad coal or an inexperienced fireman. Licensing enginemen would not relieve that condition of affairs, and it would establish a dangerous system, subject to political jobbery, and not likely to accomplish the desired end.

If there is a limit of elasticity of iron and steel, there is likewise a limit of safety to the power of endurance of the human anatomy. Admitting for the sake of argument, that some men do take hazardous chances, would they do so if discouraged and punished for it?

What are some of the causes that lead to explosions?

First. Overloading of engines, due to the selection of officials in general according to the strength of "pull" rather than the strength of brain.

Second. Selecting officials from a department who are not familiar with the mechanism of a locomotive.

Third. A theorist somewhere without practical experience, trying to make a reputation for himself as a "hustler."

Fourth. A traveling engineer who owes his position to a "pull!" That sort of man generally lacks brains. He is often a bluffer or a bully, sometimes both, and better adapted to mule-driving than the management of men. He is a demoralizer instead of an organizer and educator. I know of a case where an engineer blew his brains out rather than stand the abuse of his traveling engineer any longer. The poor fellow had just completed a 40-hour trip and was in no condition to stand abuse. This same traveling engineer does not approve of his men reading Railway and Locomotive Engineering, they censured him several years ago for asking men to do the impossible.

Fifth. High steam pressure and bad water districts where men have to take chances in order to move traffic at all.

I know of cases where bad water and 225 pounds steam pressure necessitated the removal of side sheets from engines only six months in service, and that road has been free from explosions ever since it adopted regular and systematic inspection of boilers.

With continually added improvements, to protect life and property, we force increased responsibility on the engineman. Let him be ever so competent or careful, we are apt to overtax his brain. No license from a State Board of Examiners can remedy that evil.

One of the bad features of such a license system would be the flooding of the country with correspondence schools of the get-an-education-and-promotion-quick kind. We already have a foretaste of this in the horde of agents traversing the country at the present time, distributing seductive literature, and whose sole object is to coin money by touching the enginemen's purses.

Of course, there are some good correspondence schools, deserving of support, and not to be classed with that sort.

With many of our roads at the present time promoting their own men, who are familiar with the physical condition of the line, it is an easy matter for the individual lines to select an examining board more competent to judge men's qualifications for managing and running a locomotive than some political board. A practical man may theorize, but a theorist without practical experience is a dangerous investment, particularly around a locomotive.

I know of no better medium for the practical railroader with little time for study than Railway and Locomotive Engineering.

It tells you that there is a cause for every explosion.

"Destroy the cause and you will avoid the effect." J. A. B.

SEEN FROM THE SANTA FE TRAIN IN CALIFORNIA.

Pounds, on Forward and Back Centers.

I note in your April number a question by "Subscriber" as to why an engine pounds harder on the forward center than on back center.

The answer is incorrect. An engine does pound harder passing the forward center. That is, if the pound is caused by a worn journal or box, or by a slack wedge. Main rod pounds are about alike on both centers. The reason is simple. When the crank pin passes the forward center the movement of the engine and frame is forward and the thrust of piston on main rod is backward, the wheel is slid backward on the rail and the loose box comes up against the advancing pedestal with a slam or the worn journal meets the back side of the box in the same manner. On the other hand, when the crank passes the back center, the pull on the main rod finds the engine and frame moving in the same direction, and the box or journal is pulled up to its space with the rolling of the wheel. The result is a much less perceptible pound. It's about like the difference between kicking a man coming toward you and one running away.

Of course an engine backing up pounds harder passing back centers. There is another question on these lines that has bothered the tribe for many years. It is, why does an engine pound worse on the left side?

One of our engineers says it's on account of "hard northeast winds." If I am not mistaken, the real reason for this has been published. J. M. Foster.

[In answering the question referred

to, we dealt with main rod pounds. The reason why an engine with loose boxes pounds worse on the left side is given in another column.—Ed.]

A Southern Pioneer.

I enclose herewith print of the old engine "Tornado," which, with five others like it, was built in England during the 40's for the Raleigh & Gaston R. R., now the S. A. L. Railway. I had hoped to get a picture of old Uncle Rufus Horton, living near the city, who ran this engine 55 years ago, to send you with it, but he rarely comes into town now. This engine will be appropriate for use in your "Growth of Locomotive," now in RAILWAY AND LOCOMOTIVE ENGINEERING. The picture was kindly made for me by Prof. W. F. M. Goss, of Purdue University, Indiana, where the old engine now is.

HENRY M. REECE,
R. F. S. A. L.

Raleigh, N. C.

RALEIGH & GASTON'S PIONEER.

Heat Phenomenon.

I have been much interested in reading the answers to Mr. Chenowith's article in the January number of your valuable paper, but the answers seem a little vague. One can find an excellent description of this phenomenon and its causes in Tyndall's "Heat as a Mode of Motion," lecture V. In one place Mr. Tyndall says: "I have seen Mr. Boutigug myself pass his wet hand through a stream of molten iron and toss with his fingers the fused metal from a crucible; a blacksmith will lick a white-hot iron without fear of burning his tongue." Mr. Tyndall explains this as follows: In touching some intensely hot surface with the hand the screen of vapor is formed from moisture on the hand which effectually prevents the hand from actually coming in contact with the heated surface till the vapor has all been burned away, which will then allow the hand itself to bear on the heated surface and will result in a burn.

It is for this reason that a tea-kettle of boiling water can be held in the hand, but it cannot be held there for more than 30 seconds, for by that time the vapor caused by the moisture on the hand will have been burned away and will allow the hand to come into direct contact with the hot surface.

For another example of this take a white-hot iron ball and drop it into a basin of cold water. For a few moments it causes very little bubbling, as its great heat is sufficient to form a screen of vapor about it, but soon it is so cool that it is unable to longer maintain the wall of vapor and the water comes in direct contact with its hot surface and violent ebullition follows for a few moments. This is a simple experiment; any one can do it, and it practically explains the phenomenon.

Mr. Tyndall has gone so far as to freeze water in a white-hot crucible, which is fully explained in this lecture, by chemically forming a screen of vapor between the water and the side of the crucible.

From this I think it can easily be seen that the vapor formed by the moisture on the hand in coming in contact with the hot side of a fire-box sheet seems cold for a few moments, but I think that if Mr. Chenowith held his hand against it longer than 30 seconds he would get burned.

ALLEN S. WEEKS.

Boston, Mass.

When a small boy, I had in my possession a little book called "Parlor Magic," which contained, among other feats, the trick of holding a boiling tea-kettle on the bare hand. But, with special injunctions that the bottom of said kettle be well covered with soot, which, being a complete non-conductor of heat, protects the hand from injury.

This, I believe is the solution of the phenomenon in regard to the fire-box sheets, as described by Mr. W. B. Chenowith.

E. W. GREGORY.

Hoffmanville, Md.

To Make Compound Locomotives Efficient.

With the existing difference of opinion in regard to the advisability of using compound locomotives it would seem that the question, in some respects at least, was yet to be decided. If we look over the experience of the last few years we will find that many conditions have been met with, that have interfered with the proper performance of these engines, and that the results obtained from them in many instances have not been all that could be desired. Without doubt the future will produce new features in the compound that will increase its efficiency. But it is safe to say that what is most needed at present is a better knowledge of the construction and operation of this type of engine by all connected with their maintenance and operation. With a better understanding of the subject and the engines in the service to which they are adapted, we can look for satisfactory results. That the different builds of compounds have their advantages there is no question. The cross-compound, with one high and one low pressure cylinder, such as the Schenectady, the Richmond, and the Rhode Island, with automatic intercepting valves, differ but little in their operation, and judging from my personal observation will produce the best results from an economical standpoint under conditions favorable to the engine. The Schenectady and the Richmond seem to be the favorites, and I should say there was but little difference in the results obtained from either except that the Richmond has the advantage in drifting, due to the by-pass valve used on the low-pressure cylinder of that make of engine. One fact in connection with these engines that has been brought to my notice, particularly so where they are used on comparatively level roads, is that the power of the engine covers too wide a range. Of course this fact is an advantage from the trainmaster's point of view. We will, however, find it a disadvantage in considering the welfare of the engineer and also from an economical standpoint. It is in regard to the latter that I wish to speak.

All who are acquainted with the

two-cylinder compound are aware that the best results are obtained with these engines when loaded pretty close to their limit—I might say when engine can be worked with wide open throttle and lever three or four notches below half stroke. The power is then very closely equalized on both sides and we are getting the benefit of the full expansion of high pressure steam and have sufficient volume of exhaust to make the engine steam freely. It is under these conditions that the compound produces the best results and it will be found that with either the two cylinder or the tandem type the wear on the machinery will be no greater than with a simple engine developing the same power. I have noticed on many roads where these engines are used that the tractive power is such that it would not only be inadvisable but would be almost impossible to load them to their full capacity. The result is the engines are being run with light throttle and about half stroke cut off.

The engine does not make steam and the results are unsatisfactory all round. Condensation is increased where we wish to decrease it, thus wasting the steam, and the effect is soon noticed upon the machinery, for the cylinder packing will not only have to be renewed often, but pounds will develop quickly in boxes and rods. If in many cases the size of cylinders were reduced without making any further change the engines would be much more satisfactory.

The Vauclain four-cylinder compound, while we frequently hear it severely criticized, seems to have its advantages. One is that it is well adapted to high speed heavy passenger work. Without doubt much of the complaint we hear against these engines is due to the arrangement of cylinders, valves, etc., and to the same causes which produce unsatisfactory results with the two-cylinder compounds. For it is of equal importance that the power should be equalized in the high and low pressure cylinders. In my opinion it would be advisable to have but three working notches in quadrant and so located that the cut-off will be such as to about equalize the power in the high and low pressure cylinders.

I believe all will agree with me when I say the high pressure cylinder should always be located above the low. The tandem compound being new in the field is not as well known as the others. It has already had troubles of its own that have no doubt influenced opinion against it to some extent. But I will not hesitate to say (and I believe I am well qualified to speak on the subject) that its troubles do not in any way reflect upon the compound feature of the engine. While in my opinion the tandem will not show the economy of the two-cylinder compound it has features that will make it a more desirable engine for most railroads. The one most noticeable is that it offers a wide range of service, and can be used either for light or heavy service with good results. Under all conditions the power is the same on both sides of the engine, and as the power of both cylinders is transmitted to the cross-head by one piston rod it makes no difference how the power is distributed in the cylinders.

Thus it can readily be seen that while the full benefit of the compound feature of the engine will not be realized when running with light throttle and short cut off, it has no bad effect upon the engine, and while it is not advisable to do so, except at very slow speed, the engine can be worked simple with the same result. It does not matter which compound it is, it is important that it should be adapted to the service in which it is working. We should not be surprised to see a great, heavy consolidation, with a 56-in. wheel and weighing perhaps 200,000 lbs., tear herself to pieces in a few months' time on a forty-mile-per-hour fast freight; where, with a mogul, or ten-wheeler, with a 60- or 69-in. wheel, and weighing about 175,000 lbs., the effect would be hardly noticeable on the lighter engine.

In order to obtain the results that are expected with the compound locomotive, it must be in good condition. Perhaps this will explain the remark so often made that "compounds do well in the hands of their friends." I do not mean to say that they must always be new, for we would not expect to give a compound general repairs any oftener than any other engine doing the same work. But I do say they should not be expected to pull trains with defects existing that would put a simple engine out of business. Defective cylinder packing, for instance, which is noticed immediately with a simple engine is often not detected in a compound until it is either all gone or begins to affect the engine in some other way. The fact that a compound engine will continue to do business under such adverse conditions is detrimental to its welfare and is responsible in many instances for the unsatisfactory results obtained.

I will say that I know of no greater annoyance or expense to a railroad than one of these engines in service which, when the engineer opens the throttle, he is not sure whether the engine will go ahead or back up. I have had opportunities to observe many such cases, and even worse. Usually the damage and trouble that such an engine will cause on the road is enough to condemn all the compounds on the division. In order to have, and to keep, these engines in good condition it is necessary, as before stated, that all concerned should be familiar with the construction and operation of the compound feature. Defects in the operation of the engine would then be immediately noticed by the engineer, the cause discovered before the trouble became serious, reported by him in an intelligent way and repaired without the workman having to dissect the whole engine. We would then find that the increased cost of repairs over that of the simple engine would be only in proportion to the increased number of parts contained in the compound which in the cross-compound are very few. The necessity of holding the engine out of service would then be no more than with any other engine.

The writer has seen many cases that fully illustrated the necessity of a better knowledge of the subject. For example, an engineer came in after making his trip with a cross-compound, Schenectady built engine, and reported that he thought there was something wrong with his engine, as it had acted strangely during the trip and upon one occasion had positively refused to move until another engine came along and gave it a start. However, he was unable to give any definite information as to what the trouble was. After a whole day's work on the part of engine-house men, when they came to run her out it was necessary to get a switch engine to put her on the table, simply because they had put the intercepting valve in upside down. The original trouble was probably due to the engineer "washing out the stack" or his neglect in properly lubricating the intercepting valve. Here was the engine out of service thirty-six hours, with a bill of expense charged up to her when she should have been on the road pulling her train.

As the compound locomotive represents a higher standard of mechanical ability, with little complication, we should consider it not only a duty but a privilege to become familiar with it and undeavor to see that it receives fair and impartial consideration. Then will the question of its advantages be fully and fairly decided. The writer does not wish to create the impression that he believes the compound suitable for all kinds of service. His many opportunities to study the service on various roads throughout the country have convinced him that there are conditions under which better results would be obtained with simple engines.

W. A. BUCKBEE.

Rensselaer, N. Y.

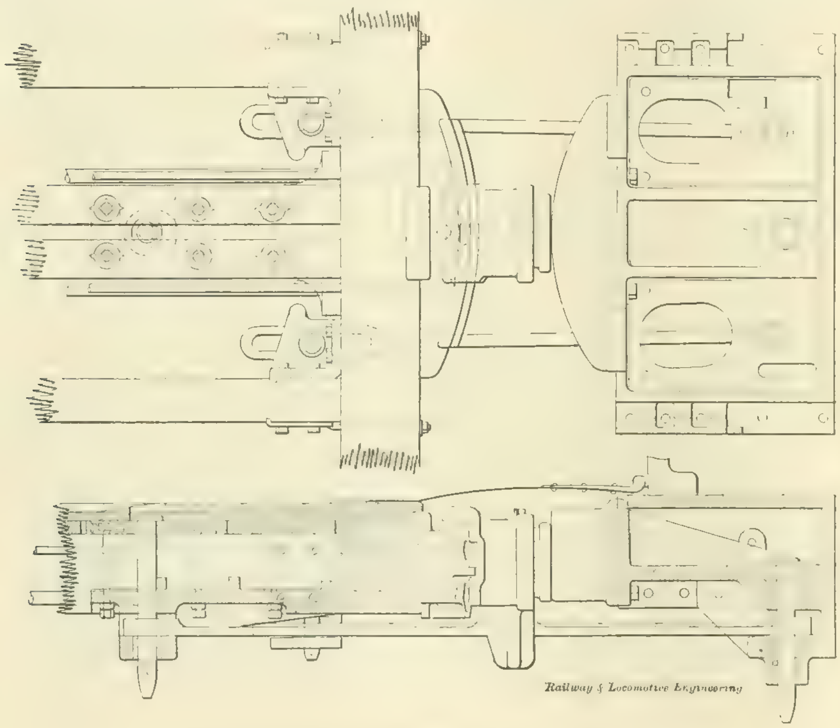
The Southern Pacific Company have a Cooke engine which makes a train mileage of 124,000 miles per month. She is washed out every day and calls for very light boiler repairs. We expect to illustrate the engine soon.

Radial Spring Buffer between Engine and Tender.

The Philadelphia, Wilmington and Baltimore Railroad have designed what they call a radial spring buffer, for use between engine and tender. The loco motives equipped with this new arrangement are intended to run upon curves of 70-foot radius, and so handle cars in and out of old-fashioned private tracks, switches, etc., which were built in the days when the wheel base of engine and tender were much shorter than they are now. These tracks have not, and in many cases now, cannot very well be altered for the better.

Our illustration shows a flat shackle-bar between engine and tender which is pinned at either end in the usual way. On the front of the tender and on the back of the foot-plate two castings are bolted, the outer edges of which are curved with such a radius as would be got with the pins for centers in either case. The casting on the back of the foot plate has a perfectly plane face and it is used as a rubbing or chafing casting. The similar casting on the front of the tender is horizontally ribbed and carries a hollow casting which is free to slide upon the curved face, and which has grooves which engage with the ribs of the tender chafing casting. The hollow casting contains a spiral spring, the outer end of which bears upon what may be called a plunger, which fits easily into the hollow casting. This plunger or buffer casting presses directly against the smooth chafing casting on the engine, and the compressed spring always keeps buffer and chafing piece in close contact. The hollow casting has also two deep lugs which pass down on either side of the flat shackle-bar, so that as engine and tender pass through a sharp curve the lateral motion of the shackle-bar carries the radial buffer with it, either to the right or to the left, as the case may be.

By this arrangement the engine and tender are able to stand at a considerable angle to each other as the curvature of the track demands, and yet the distance between each is always preserved intact without lost motion or undue strain. In fact, the ordinary slight wear of pin and shackle-bar holes is automatically taken up by the spring buffer. The increased space between engine and tender necessitated by this arrangement is covered by an apron of ample dimensions. It will be noticed that the safety chains are replaced by two eye-bars pinned securely in the foot-plate, but with long slots at the tender end, through which pass two pins upon which pulling may be done when either or both of the safety-bars draw out to the end of their slots.



RADIAL SPRING BUFFER, P. W. & B. R. R.

When the engine and tender are uncoupled the buffer casting is prevented from being thrown out by the spring behind it, by a set screw in the upper part of the hollow casting. Altogether the whole arrangement forms a neat and efficient device which secures the needed flexibility between engine and tender when working on the crooked track for which it has been designed.

Mr. D. P. Kellogg, general foreman of the Southern Pacific shops at Oakland, whose attractive contiibutions to RAILWAY AND LOCOMOTIVE ENGINEERING are well known to our readers, also manages a class for the instruction of those interested in locomotive mechanism. He has a variety of air-brake mechanism and several charts which learners find sufficient when explained by such a master of the air-brake art as Mr. Kellogg. He also has a small valve motion model which he makes the best of, but he is ambitious to have a full size model which will show the minute movements of the mechanism and clearly demonstrate the effect of small changes. A general foreman ambitious to have motion of this kind to use for the instruction of the company's employees ought not to have much difficulty in getting one made. But when the work of repairing locomotives is chronically ahead of the facilities, the construction of a valve motion model must naturally wait.

Mr. John H. Converse, of the Baldwin Locomotive Works, Philadelphia, recently said to a newspaper reporter: "We are working night and day, and we are turning out on an average one complete locomotive every four hours. The various branches of our plant are rushed. The demand for motive power by the railroads does not seem to slacken." At this rate, and assuming that the total average length of an engine and tender is 50 ft., the Baldwin works could fill a mile of track in 17 1-2 days with 105 engines. A year's work would require more than 20 miles of track to hold the output of the works, and when filled would contain 2,190 engines if the works were operated every day in the year, which of course they are not. Some people have been known to describe Philadelphia as a slow town.

"The People You Meet in the Dining Car," is the title of a neat little bit of illustrated railroad literature issued by the Chicago & Alton. The literary man, alone, silent, observant of details, *writes* out his order, mark you, in the Alton's diner.—The ubiquitous, voluble story-telling drummer, like Othello recounting perils "i' the imminent deadly breach." The pretty girl alone; again soon one of a family party—the country farmer with napkin comfortably tucked in at the collar, with knife and fork in hand, ready for the feast; mentally appraising the value of the land he looks out on, from the car window. Then the people you don't meet, are shown also—they are the most important people of all—the chefs —but the Alton looks out well for them, it's "the only way"—ask the Alton if you would like to have a copy.

Half a loaf's better than no bread, and the same remark holds good with crumbs.—*Captain Cuttle.*

Atlantic Type Passenger Power for the Erie.

The Baldwin Locomotive Works have recently supplied the Erie with some very substantial Vauclain compound 4-4-2 passenger engines. The sizes of the cylinders are 15 and 25x28 inches, and the high-pressure cylinders are placed on top. The driving wheels measure 76 inches outside the tires, and the weight carried by them amounts to about 88,000 pounds. The total weight of the engine is about 180,000 pounds. The drivers and carrying truck wheels are equalized together, and the valve motion is indirect, with transmission bar passing below the leading driving axle. The valves are of the piston type. The guide bars are very securely fastened to the spectacle plate by a heavy steel casting which passes completely around the ends of the guides.

The boiler is of the straight-top variety, with wide fire-box for bituminous coal, this, however, is not quite as wide as the ordinary Wooten type, thus allowing the cab to be placed at the rear of the engine. The boiler is 64 inches in diameter at the smoke-box end. The total heating surface is 2,811 square feet. The tender has a hood over the front of the fuel space for the protection of the fireman, and the tank has a water bottom. The water capacity of the tank is 7,000 gallons, and there is back step, hand rail and ladder for the fireman, so that the tank man-hole may be conveniently reached.

These engines altogether are very similar to those built last year at the Baldwin Works for the Erie, except that the ones here illustrated are arranged to burn soft coal. Though the position of the cab differs from that of the hard-coal burners, these engines have been made with parts interchangeable as far as possible, to suit the former design.

Some of the principal dimensions are as follows:

Cylinder, 15 and 25x28 in.
Boiler, diameter, 64 in.; thickness of sheets, 11/16 in.; working pressure, 200 lbs.
Firebox, length, 102 in.; width, 66 in.; depth, front, 66¼ in.; back, 57½ in.; thickness of sheets, sides, [illegible] in.; back, [illegible] in.; crown, [illegible] in.; tube, ½ in.; water space, front, 4 in.; sides 4 in.; back, 4 in.
Tubes, wire gauge No 12; number, 305; diameter 2 in.; length, 16 ft. 6 in.
Heating surface, firebox, 172 sq. ft.; tubes, [illegible] sq. ft.; total, 2,811 sq. ft.; grate area, 46.75 sq. ft.
Driving wheels, diameter outside, 76 in.; journals, 9x12 in.
Engine truck wheels, front, diameter, [illegible] in.; journals, 6x12 in.
Trailing wheels, diameter, 50 in.; journals, 8½x12 in.
Wheel base, driving, 6 ft. 7 in.; rigid, 13 ft. 10 in.; total engine, 26 ft. 3 in.; total engine and tender, 52 ft. 2 in.
Weight, on driving wheels, 88,000 lbs.; on truck, front, 48,000 lbs.; on truck, back, 44,000 lbs.; total engine, 180,000 lbs.; total engine and tender, about 310,000 lbs.
Tank, capacity, 7,000 gals.
Tender, wheels, 33½ in.; journals, 5x9 in.

Want to Make Frick President of the Steel Trust.

A rumor is current in Wall street that H. C. Frick will be elected president of the United States Steel Trust at the meeting of the directors next month to succeed Charles M. Schwab. The talk is that the Morgan interests have determined upon the election of Frick, and that they have the votes to carry out their purpose. Those who regard the change as certain appear to have overlooked the influence of Andrew Carnegie in the Steel Corporation. Mr. Schwab is Mr. Carnegie's choice, and he is not likely to be displaced without a fight, especially as Mr. Carnegie has no love for Mr. Frick. The Homestead conflict was due to Mr. Frick's action, and it brought a great deal of undeserved obloquy upon Mr. Carnegie which is not forgotten.

Learning about details of their business appears to be particularly popular among railroad men in the neighborhood of San Francisco. Mr. E. M. Cutting, assistant signal engineer of the Southern Pacific Co. at Oakland, carries on an instruction class for the men engaged on repairing and caring for signals, and the men display a keen interest in acquiring knowledge concerning the mechanism. Mr. Cutting has a variety of signal mechanism cut in sections to show the operating, and that is supplemented by sectional drawings of other parts. The men do their work much more efficiently since this school of instruction was formed, and overcome difficulties that formerly were referred to headquarters. The prevention of delay that results can easily be appreciated.

Time for Refreshments.

A Fifeshire paper tells an amusing story. For unseemly rapidity of locomotion Scottish railway trains have an infamous and dangerous repute. It is probable that the North British Railway is the hero of this yarn: *Golfer* (who has been doing St. Andrews, after unusually long stoppage at small station)—"I say, guard, why aren't we going on? Anything wrong?" *Guard* (who is peacefully taking his lunch)—"There's naething wrong. But I canna whustle the noo; my mouth's fu' o' biscuits."

The Baldwin Record of Recent Construction, No. 41, is entitled "Some Notable Trains," comprising the special train recently run over the Atlantic City Railroad for the visiting English railway officials, also the regular Atlantic City flyer which makes daily trips between Camden and the famous seaside resort. The Philadelphia and New York service is represented by a train drawn by one of the P. & R. "bicycle" Vauclain compound engines. Following these are the Alton Limited, on the Chicago & Alton Railway; the Overland Limited, on the Union Pacific; a train of the same name on the Southern Pacific; the C., B. & Q. "Fast Mail;" the "Pioneer Limited," on the C., M. & St. P.; the famous "Prince Henry Special," on the same road; the Canada Atlantic and the Canadian Pacific Limited trains between Montreal and Ottawa: the Royal Blue Line on the New York, Baltimore & Washington; a typical Lehigh Valley train of steel coal cars, and a train on the "Cog-Wheel Route" via the Manitou & Pike's Peak Railway.

ATLANTIC TYPE VAUCLAIN COMPOUND FOR THE ERIE.

Railway and Locomotive Engineering

A Practical Journal of Railway Motive Power and Rolling Stock.

Published monthly by

ANGUS SINCLAIR CO.,

174 Broadway, New York.

Telephone, 984 Cortlandt.
Cable Address, "Loceng," N. Y.
Glasgow, "Locauto."

Business Department:
ANGUS SINCLAIR, President.
FRED M. NELLIS, Vice President.
JAMES R. PATERSON, Secretary.

Editorial Department:
ANGUS SINCLAIR, Editor.
F. M. NELLIS, GEO. S. HODGINS, JOS. A. BAKER, Associate Editors.

Advertising Department:
Eastern Representative, S. I. CARPENTER, 170 Summer St., Boston, Mass.
Western Representative—J. A. BAKER, 1204 Monadnock Block, Chicago, Ill.

British Representative:
THE LOCOMOTIVE PUBLISHING CO., Ltd. 102a Charing Cross Rd., W. C., London.

Glasgow Representative:
A. F. SINCLAIR, 7 Walmer Terrace, Ibrox, Glasgow.

SUBSCRIPTION PRICE.

$2.00 per year, $1.00 for six months, postage paid to the United States, Canada and Mexico. For other parts of the world, $2.50, or ten shillings. Single copies, 20 cents. Remit by Express Money Order, Draft, Post Office Order or Registered Letter.

Mailing address can be changed as often as necessary—always give old and new address, and if you subscribed in a club state who got it up.

Please give prompt notice when your paper fails to reach you properly.

Entered at Post Office, New York, as Second-class mail matter.

Encouraging Inferior Work.

There is a great deal of truth told in few words in the letter "A Machinist's Point of View," which appears in our correspondence department. The letters of other correspondents and personal observation convince us that in railroad shops generally, practices favoring the production of inferior work are fearfully on the increase. Railroads as a rule are very scarce of motive power at present, and it is natural that all concerned in moving the traffic should strive to have repairs effected as expeditiously as possible, but that is no excuse for the encouraging of the production of inferior work at the hands of individual mechanics. Yet this is undoubtedly becoming a common practice. There is no excuse for it, and the fact that locomotives are feverishly in demand, instead of excusing inferior work being done, is a weighty reason why the work should be finished in the most durable manner possible.

The railroad companies are earning so much money and are so prosperous that it is simply infamous that a spirit should be growing which encourages the production of inferior work, by the practical worship of nasty cheapness, for it is playing with the lives of men. This is no exaggerated note of alarm, for we are writing with personal knowledge of facts that are almost incredible. We do not say that the managers deliberately require their mechanical departments to put inferior work upon their motive power, but their policy amounts to the same thing. They make far-reaching researches of the cost of repairs of motive power on various railroads, and keep repeating to the head of the mechanical department, why is our cost of repairs so much higher than that of the Skeem & Falsify road? The superintendent of motive power explains that the conditions of operating are entirely different, but his explanations fall upon unsympathetic ears; the merits of his defense are doubted, and he is told that he must endeavor to do better. Seeing the coming of an invitation to vacate his office, he passes his embarrassing position upon his master mechanics and urges them to do better, with the result that some of them begin encouraging their men to turn out work quickly, no matter what its quality may be.

The big railroad combinations have had the effect of intensifying this evil. When a new system is absorbed the officials compare the shop performance with the best performance of the parent system; and finding it does not make a favorable comparison, the men in charge are informed that they must do better or get out. It is not taken as any excuse to be informed that all the shop tools in use on the newly absorbed system are antiquated and away below the capacity of those used on the divisions whose efficiency they are expected to equal. The fiat given out is the savage notice—improve your output or quit. Few foremen and master mechanics are ready to throw up their positions, so they try to save themselves by pushing the strenuous condition upon the men. They can do a job more quickly than they were accustomed to do it only by slouching the work. A story is told of an affectionate father giving advice to his son who was about to leave home. "God bless you, my son," exclaimed the affectionate parent, "may you prosper and be happy. The leading aim of a young man should be to make money. I say, make money honestly, if you can, but make money."

The mechanic of a combination-ruled modern railroad shop is not only advised but forced into the position of the affectionate parent's son. His covert instructions are—get the repairs done in short time, get the work done properly if possible, but get it done quickly.

This policy deserves the strongest kind of condemnation for various reasons. It reduces the reliability of railroad machinery, which is always too liable to accident, since the strongest material, fitted in the most perfect form known to the cunning hand of the skilled workman, is liable to fail under the terrific shocks of fast-speed train service. When perfect work sometimes fails slouch work is a constant menace to the people traveling on railway trains, since it seriously increases the liability to accident.

The system is the most expensive policy for a railroad company to pursue, for they will have to pay for good work in the end, and may have to add a heavy premium for expense of accidents, to say nothing about loss of human life.

If a railroad manager wanted to spread discontent and bad feeling throughout the whole system he could not find an easier way to effect it than by having locomotive repairs slouched. Bad fitting of rubbing parts will bring annoyance and failures from heating, badly rolled tubes and other boiler work done in inferior shape will cause leakage, so between bad fitting on moving parts and miserable boiler work, engine failures become a grievous burden. The blame cannot be located with exactness, so it is shifted about, exasperating high and low.

The practice demoralizes the workmen and their day of reckoning will come as sure as the sun rises and sets. The average run of workmen is conscientious and honest, and, in addition to that, love of his calling moves him to take pride in work well done. It is a woeful condition of affairs when his employers, or the conditions of his employment, impel him to degrade his handiwork. A matter of pride to Americans has been the interest that mechanics took in their work, an interest which induced thousands of them to invent appliances for increasing and perfecting production. A mechanic who is constantly pursued by the order to slouch work is not likely to use his brains up devising labor-saving means or methods. Under the system the best of men become time servers and all *esprit de corps*, or pride of employment, slowly but surely gets rooted out.

Dissolution of the Northern Securities Company.

The United States Circuit Court has just rendered one of the most momentous decisions ever decided in the United States. It has declared that the merger of the securities of the Northern Pacific and of the Great Northern Railroads, effected by J. Pierpont Morgan and James J. Hill, is in violation of law, and an injunction was granted against the continued operation of the merger. All the four judges concurred in the decision, which is regarded as against the probability of the United State Supreme Court reversing the decision. The most important point in the decision reads: "It placed the control of the two roads

in the hands of the securities company, by virtue of its ownership of a large majority of the stock of both companies; it destroyed every motive for competition between two roads engaged in inter-state traffic which were natural competitors for business, by pooling the earnings of the two roads for the common benefit of the stockholders of both companies, and, according to the familiar rule that everyone is presumed to intend what is the necessary consequence of his own acts, when done wilfully and deliberately, we must conclude that those who conceived and executed the plan aforesaid intended, among other things, to accomplish these objects."

The defendant in the suit insisted that the rates charged by the combination were reasonable, but the Court held that the rates charged had no particular bearing upon the merits of the case. The vice of such a contract or combination was held to be that it confers the power to establish unreasonable rates, and directly restrains commerce by placing obstacles in the way of free and unrestricted competition between carriers who are natural rivals for patronage. The corporation's contention that the combination was really in aid of commerce is fitly characterized as a "novel, not to say absurd, interpretation of the anti-trust act," and the court has no doubts about the validity of the act and the constitutional powers of Congress in the premises.

The issues are so clear that all these mergers appear simply as examples of conscious lawbreaking, and the decision will be hailed as a triumph of law and as a victory for the people which must strengthen their confidence in the administration of the law. It is certainly a welcome check upon dangerous corporate aggression.

The practice of combining railroad control so that enormous properties came practically under one management, threatened to go on until all the railroad property in the country would be under the control of a few bankers. Several new huge combinations not frequently known, were being worked into shape, but the decision on the Northern Securities merger will frustrate the schemes.

An impression prevails among business men that the decision of the Court on the Northern Securities Company is a direct blow at all trusts and great combinations of capital which have been organized in such stupendous forms of late years for the controlling of certain industries. If the Northern Securities Company can be dissolved because it acts in restraint of trade and competition, there are certainly other huge trusts that act in the same way and suppress competition more relentlessly than the railroad combinations have ever thought of doing. First among these is the United States Steel Trust, which is on a fair way to control every steel making industry on this continent.

If the discussions in the daily press are to be relied upon to reflect public opinion, several railroad combinations now holding trade by the throat will soon be prosecuted under the anti-trust law, particularly the New York, New Haven & Hartford combination. The Pennsylvania Railroad Company will, if the predictions come out true, have to drop the Baltimore & Ohio and other lines which were competitors of the Pennsylvania before they were absorbed.

Future action is a matter of speculation, but we feel certain that the prospects of all railroad officials, except the large capitalists, will be improved by the decision that law puts restraints upon the ambition of capital, and will be enforced. The dread and anxiety of many men who were constantly apprehensive of changes that would throw them out of employment, is at an end and many a household will be made happier by the Court's decision in the Northern Securities merger case.

Car Details.

Steel in freight car construction has become so well established as a standard that wood for the purpose may be said to be well out of it, as practically all of the large recent orders specify steel except for box cars, in which it has been the practice of late to split the difference and make the sills of steel and the superstructure of wood. Why this lone exception stands to mar a fine record of progress no one is ready to explain—if indeed such a glaring inconsistency can be satisfactorily cleared up. The friends of the steel car can afford to wait, however, knowing that time in the fullness thereof will see the change from wood to steel, full and complete for all rolling stock. While this consummation will be welcome, there are some things about car details that force themselves on our attention, for the reason that many of them have been worked out from every view point but that of the mechanic. Among these are center plates, in which the necessity for a low coefficient of friction has apparently been lost sight of, and the relation it bears to flange wear and curve resistance.

To those who have given the question proper thought it is plain that influences that hold the truck tangentially on a curve, other than those due to centrifugal action can be eliminated. The most serious of these is side bearing contact, and the next in importance is the resistance of the center plates to prevent the truck from assuming its correct position normal to the curve. Instances are common where the wheel flanges bear hard on the outer rail of a curve and hold to that position for long distances after reaching a tangent, in many cases retaining a bearing hard against the rail until a reverse curve is reached. Sharp flanges are the logical outcome of this condition, and broken flanges should excite no comment when from any cause a truck cannot easily enter and leave a curve. In the agitation for a cast-iron wheel to meet the requirements of the 100,000 pound car, great stress was laid on the weakness of the present wheel flange, and much alarm was expressed at the difficulties in the way of strengthening the flange for safe service under the heavy equipment. There is every reason to believe that with good material in the wheel the original thickness of flange of 1¼ inches will be amply strong for the heaviest rolling stock, if the flange is given a chance to perform its legitimate function of guiding the wheel with perfect freedom. As a means to that end it is of the greatest importance that the center plates offer the lowest possible resistance, and that the side bearings remain apart. Center plates to fulfil these conditions should be of the ball-bearing type; if these are not available a fair substitute can be had in the plain variety, and they should have flat bearing surfaces of an area large enough to prevent abrasive action under load. The upper plate should have a flange extending down over the lower, thus reversing the usual order of construction, and the bearing surfaces should be machined. Such a center bearing when lubricated, as it should be, would pay for its low extra cost in decreased train resistance and flange wear on curves.

The failure of the average center plates to prevent a free swivelling action between car body and trucks, is quite often the result of a deflecting body or truck bolster—either of these may be so weak as to cause the load to be carried on side bearings as well as center plates—it is therefore plain that when such a weakness is present, a frictionless center plate would not solve the problem. A fairly intimate acquaintance with bolster lore prompts the statement that no other detail of a car has received more attention—such as it was—and profited less, than the bolster; the reason for such a peculiar situation is no doubt the want of a correct understanding of the technics of the case. The multiplicity of weak designs of this detail proves this proposition. One of the most aggravated examples of this kind is the two-plate type—a beautiful scheme on paper, but lamentably bad in metal. A bolster of this brand is the weakest thing that could be devised to support a load, with the possible exception of the wooden arrangement, and yet these "failures" are still put under cars. One of the two-plate kind of bolster was noticed recently on

some drawings for new 60,000 lb. cars, where the plates were ½ inch thick by 12 inches wide; this was positively the worst case among many bad ones, and it is difficult to conceive an arrangement better calculated to let the side bearings come together. It probably never occurred to the designer to dispose his material with the sides in a vertical plane and have a bolster with a resisting moment of some value. This is the "head and front of offending" in every instance, that the problem is approached by any but the man who is conversant with stresses and how to provide for them—in other words, the engineer—and he is not infallible. If liability to spreading rails, broken flanges and excessive resistance on curves is be avoided, the bolster must be made to stand up without deflection under the load.

It is not necessary to go on a still hunt for trouble with car details, they are ever present in too many tangible shapes to be forgotten, or ignored when known. The draft rigging is another place that gives evidence of the need of care, more now than ever since heavy cars are here. In this detail there are two points to consider in order to gain the highest efficiency, namely: The location of the drawbar so that the center line of draft coincides with the longitudinal center line of sills as nearly as possible, for the purpose of eliminating the lever arm through which the draft and buffing forces act. The necessity for a device that will absorb these buffing strains is a serious one, and while there is such a draw gear which uses friction as the medium for the purpose of absorbing shocks, we have the old spring drawbars which absolutely fail under many conditions, and these are continued in use with a full knowledge of their shortcomings, when the limit of improvement has not yet been reached for this kind of a gear.

The arrangement of truss-rods affords a fine field for the mechanical juggler, and this can be verified by a random examination of different car drawings published in the technical press, which will make it evident that the principles of moments or parallelogram of forces is as Sanscrit to some who ought to know. If this were not so, truss-rods would be made to deposit their loads as near the center of the bolster as practicable, and more attention would be given to the question of depth of truss and also the spacing of cross ties, all of which exercise the greatest effect in reducing fiber stresses. These points embrace the need of improvement in a few car details; others will be treated later.

Electricity vs. Steam Power.

Some very sensational statements have recently been cabled out from England as to what is alleged is about to be done in the matter of the substitution of electric traction for that of steam power on important lines in the United Kingdom. From what has been said and written on the subject, one might almost imagine that the British engine driver and fireman would hardly have time to take their overalls off the discredited locomotive before it was consigned to the scrap heap as a useless and antiquated machine. We have repeatedly noticed that the dear old locomotive of our youth has been from time to time, joyfully consigned to oblivion by sensation-mongers, and the whole thing is taken as gospel truth by the thoughtless or the ignorant.

As a matter of fact, what little fire gave rise to so great a cloud of smoke was briefly that the representatives of two British companies, conferred together for the purpose of arranging that the electrically propelled trains of the one should be able to run over the lines of the other. The two corporations are said to have been the Metropolitan and the District (underground) railways of London. How it happened that a system of what we would call car interchange, and the necessary adoption of similar electrical standards by two companies, could have been regarded as in any way foreshadowing the retirement of the locomotive throughout the British Isles, is known only to that class of writers, who, along with the heathen, according to Holy Scripture, "imagine a vain thing." This matter is of interest to us inasmuch as the retirement of the locomotive in one country would practically mean its abandonment in others.

With regard to the substitution of electricity for steam on trunk lines in England it has been said that one of the reasons which induced Mr. James Holden, locomotive superintendent of the Great Eastern, to design his suburban "Decapod" (which was illustrated on page 191 of our April issue), was that steam power so applied was cheaper than the installation and operation of electricity. It was stated that the maximum service which electricity could give with traffic existing on that portion of the Great Eastern Railway, where the "Decapod" operates, is a three-minute service. Mr. Holden's new engine is expected to give the same service, but with longer trains. The cost of electrification, according to a foreign technical journal, would be fully £2,500,000, whereas the one-hundredth part of that sum would be sufficient to build 50 engines of this "decapod" class, and strengthen any of the bridges which might require it.

An interesting writer on this subject, Mr. Alton D. Adams, in a recently published article, holds that electric traction has proved its superiority for distributed loads. That means that for short trains frequently run, electric power is better than that of steam, but that while concentrated loads are moved at intervals of several hours, steam locomotives are unquestionably the more economical of the two. In support of this contention he invites the hypothetical consideration of a railway 100 miles long, on which cars requiring 2,000 horse power must be kept in motion. If 20 cars required 100 horse power each, in order to move them over the road, the electric conductors and current-distributing apparatus would never be required to deliver more than 100 horse power at any one point. If, however, the traffic represented by these 20 cars be concentrated into a single train, then the conductors and distributing apparatus would have to deliver the full 2,000 horse power at each and every point along the line. This concentrated load means multiplying by twenty the capacity of the distributing apparatus designed for the short trains, and this involves a prohibitive capacity in, and cost for, distributing apparatus, unless short trains be run at frequent intervals.

The tendency of modern railroad operation in this country, especially in the handling of freight traffic, has been toward the employment of the "large car," the long train, and the powerful locomotive. These things make for economy in various ways, among which may be mentioned greater tonnage moved by fewer train crews, which offers a substantial reduction in operating expenses for wages, and reduces locomotive handling and some items of maintenance.

The whole question of steam or electric traction is simply one of dollars and cents as far as corporations are concerned, and the irresponsible predictions of flamboyant press correspondents may indeed produce startling scare heads in the daily papers, but they do not stand for anything tangible in the railway world.

If electricity ever permanently retires the steam locomotive, it will not do so in a single night. If the change comes at all, it will only be by the gradual working out of the law of evolution, which has hitherto permitted alterations to be effected so slowly that the process may be said to be tardy in the extreme. Though the "survival of the fittest" is no doubt a natural law, yet its very existence pre-supposes a struggle, for no type ever suddenly ceased to be. The introduction of any new form, be it organic, mechanical, or intellectual, has always been a slow process, by reason of the vitality and growing power of those forms which the newcomer seeks to displace. Sudden and swift revolution has no place in natural law, which always recognizes legitimate competition. This matter of electricity or steam on railways is as much amenable to the operation of natural law as is the relation of supply to demand.

Overloaded Engines are Expensive.

"The overloading of engines is a most expensive practice, occasioning more repairs than ordinarily needed, and excessive fuel consumption, it lessens the capacity of a railway, and is expensive in overtime and is indirectly the cause of train accidents," so spoke Mr. G. J. Bury, general superintendent Lake Superior Division, Canadian Pacific Railway, at a recent meeting of the Canadian Railway Club.

The speaker referred to the increase of 101.91 average trainload tons between the years 1889 and 1901 on his road. Eased grades and heavier engines in part accounted for increase, but greater loads for engines accounted for the remainder. Transportation officers, he said, know that to use minimum staff in moving a given tonnage is the most economical way to do it. If freight trains average 15 miles an hour, train crews can make 5,000 miles a month, while if the average be reduced to 8 miles an hour, men cannot stand more than 3,000 miles a month. If they make 2,500 miles during slack times for say eight or nine months in the year, they would be able to make, up to perhaps 5,000 miles for the few months of the rush. The economical plan is, if possible, to make the regular, trained staff handle a rush without dangerously overtaxing them. More men employed with trains traveling at slower speeds produces greater risk of accident, first, by introducing longer service hours, and second, by the larger employment of new men.

Mr. Bury makes a calculation in which he shows that a 2-8-0 engine hauling a train weighing 1,100 tons (tare and contents) over 118 miles up and down several 1 per cent. grades at an average rate of 8 miles an hour, would cost $41.96, or 32.3 cents per thousand miles. The cost of a train of 1,000 tons (tare and contents) hauled by the same engine over the same division, but at 15 miles an hour, would come to $34.13, or at the rate of 28.8 cents per thousand miles. The lighter train also produces less wear and tear on the engine and so reduces its maintenance account—just how much would have to be decided by actual tests extending over a given period of time.

The economical load is, of course, variable, but the speaker held that it was decidedly uneconomical to overload engines when traffic was dense, because, as he rightly said, "even one train staggering and doubling over a district will demoralize the trains following and those met, resulting in overtime, extra consumption of fuel and the risk of train accident, which increases when train and enginemen are long hours on duty."

The conclusions of Mr. Bury agree very closely with the practice urged by Mr. Roesch and other correspondents of Railway and Locomotive Engineering, that a fairly light train load is the most economical.

Why an Engine Pounds Harder on Left Side Than on the Right.

A correspondent of ours, whose letter is printed in another column, calls attention to the fact that an engine loose in her boxes pounds harder on the left side than on the right, and he humorously says this has been attributed to the effect of hard northeast winds.

It may be stated that the pound noticed in an engine having the same amount of lost motion in her boxes on both sides, will always be greatest on the side on which the "following" crank pin happens to be. In this country the left is usually the following side, so the greater pound is observed to be on the left side.

When the engine stands with right crank pin on forward quarter, the left pin is on the top quarter. When the stroke begins on the right side the existing lost motion will permit the box on that side to be driven back against the rear horn, while at the same time the crank pin on the left side is being pulled forward, and if the left side of the engine alone was working, this pull would be competent to keep the driving box on the right side away from the back horn and tight against the front. Therefore the pound caused by the motion of the piston on the right side beginning its stroke, is always opposed by the forward pull of the crank on the left side.

Consider the case where the left-hand crank is on the forward quarter and the right is on the bottom. Here the push on the right side having crowded the axle back as far as it will go on the right side, is also tending to drive the left box back. This is augmented by the straight, fair and square push back, which the left piston is able to give when it begins its stroke.

In the former case the two sides worked so that the pound was slightly neutralized every time. In the second case, the pound was produced by the joint action of both sides, and the hard northeast wind before referred to, may have helped to waft the sound of the left side pound to ears of the men on the engine.

The passenger engines on the Southern California lines of the Santa Fé with Vanderbilt furnaces, use an average of 16,000 gallons of water in five hours. That is equivalent to 25,600 pounds of water an hour, or 626.6 pounds per minute. As 20 pounds of water or its equivalent of steam per hour may be depended upon to produce one horse power, these engines develop over 1,200 horse power per hour in ordinary working.

QUESTIONS ANSWERED.

(29) E. R. M., Lafayette, Ind., asks:

What is the difference between a direct and an indirect connected engine? A.—A direct connected engine is one which is so arranged that a forward movement of an eccentric rod will produce a forward motion of the valve; and a backward motion of rod causes a backward travel of the valve. An indirect connected engine is one in which the opposite effect takes place in each case. Indirect motion is usually produced by the interposition of a rocker between valve and eccentric, the rocker having one arm above and one arm below its center, so that when an eccentric rod moves in one direction the valve will move in the opposite direction. A good and full explanation of this, and of how the eccentrics are placed on the axle for direct and indirect motion may be had by reference to the May, 1902, issue of Railway and Locomotive Engineering, page 220. The article is called "Setting Piston Valves," and is worth careful perusal.

(30) P. L. K. writes:

With a Vauclain compound, right forward eccentric strap broken and forward head of valve chamber broken, how would you block and how much of your train would you attempt to pull? A.—If the valve chamber cover was broken so as to be useless, with the Vauclain outside admission valve you would be in much the same plight as the runner of a simple slide-valve engine would be in if the steam chest cover was gone. The only possible thing is to blank flange the branch steam pipe in the smoke box. That is a most difficult thing to do effectively on the road with modern, large engines using high pressure. If you promptly ask for assistance you are likely to get it before you could get your train out of the way of others on a busy line by attempting to fix up on the road.

(31) J. R. Algiers, La., asks:

How would you handle a standard 8-wheel underhung engine for a broken tire? Engine in question is a Schenectady make, weighs 75 tons, saddle extends into driving box and is held in position by a pin through box. Is it practicable to handle this engine on the road? A.—Yes. Suppose the left driving tire had broken. Run this wheel up on a block and so get it as high as possible. Put in a couple of nuts or other convenient pieces for blocking between the bottom of box and the pedestal brace. Then block the end of the equalizer near the left trailing spring hanger by putting in a piece of wood or other material between equalizer and bottom bar of frame. Block this down as far as possible to somewhat relieve the pedestal brace. Reverse the process if the trailing tire

was broken, but be careful about backing into a siding with one of the trailing wheels in the air.

(32) H. E. S., Snohomish, Wash., asks:

Why does the crown sheet in so many makes of locomotives slope from the flue sheet down to the back of the firebox? A.—The crown sheet, placed as you describe, permits the flue sheet to be made so as to give a large area for the flues, and sloping back gives more steam and water space if the roof sheet is horizontal. It also has the advantage that when the engine is going down grade, a more uniform water level is maintained than if the sheet had been perfectly horizontal.

(33) C. H., Philadelphia, asks:

1. What is cylinder oil composed of and what process does it go through which makes it so expensive? A.—Good valve oil, such as that supplied by the Galena Oil Company, is compounded of a refined product of petroleum, with some good animal oils, the selection of the ingredients and the compounding of the mixture is done with a view to eliminate all matter which would tend to corrode the cylinders, valves, etc. Moreover, such oil must be able to withstand the high temperatures now used in locomotives and to retain its lubricating qualities under these circumstances. The more fully valve oil meets these conditions the probabilities are the more expensive it will be to make.

2. What is crude oil composed of? A.—Galena engine oil is made from Franklin crude oil, mixed with whale oil and red lead in certain proportions. known only to the manufacturers. These constituents are combined in such a way that the lead is held in solution in the oil, and is conveyed by the waste to the journal and fills up the interstices in the bearing.

(34) Subscriber, Delphos, O., writes:

We have an 8-wheel 17x24-in. engine, Rhode Island make, which, when working, the water in the glass is full of large bubbles and has always been that way. It is impossible to tell where the water is by it. The water valve is set even with the crown sheet, and steam valve is top of boiler head. Engine does not seem to be priming. Will you please explain cause? A.—It is possible that the engine referred to has a very small steam space in the boiler, and that gentle priming is going on all the time. Some locomotives are built deficient in steam room from the start. It is always safer to have the lower gauge glass mounting three or four inches above the highest point of the crown sheet, and the openings both top and bottom should not be too small. In any case, they should be kept thoroughly clean to allow free flow of steam and water.

(35) W. J. W. writes:

(1) Considering one side of a locomotive only, and considering the total pressure on the piston the same in both cases, where does she have most power or strain on the draw bar, when the main pin is directly below or directly above? A.—The maximum effort is when the crank pin is on the top, or is on the bottom quarter, the effect in each case is exactly the same. (2) Considering everything, at what point does a locomotive have most power and why? A.—When both sides are considered, the maximum power is exerted when the right crank pin is midway between the top and the forward quarters, and the left midway between the back and the top quarters. Corresponding positions or the eighth positions below the axle give equal power. The reason is that these positions form what may be called the best average position for both sides.

(36) A. K., Post Falls, Idaho, writes:

Is it not a fact that a locomotive and similar engines with link motion and valves set to give lead, with reverse lever in the center notch, one of the ports is open the amount of the lead, no matter in what position the engine stands? A.—No, this is not how the valve moves. With properly designed valve gear, and no lost motion, placing the reverse lever in the center of the quadrant, ought to shut off steam from the cylinder altogether. An interesting point is that with piston at one end of cylinder, the valve will be open, the amount of the lead, if the reverse lever is full ahead or in full back gear. You would be able to work out many of these problems for yourself if you had one of our valve motion models.

A short time ago, Mr. W. L. Derr, superintendent of the Erie Railroad at Jersey City, introduced a novel and most effective plan for having passenger trainmen present a neat and trim appearance. At the beginning of every month each man who is entitled to the privilege is provided with a ticket which is honored at certain establishments. The tickets are "good" for various services, and the company pays for them. The holder of one of these tickets is entitled to have his trousers cleaned and pressed twelve times in the month, and other articles of apparel six times in the same time. It also secures the services of boot-black twenty-five times. Mr. Derr, in his circular, requests the men to be very particular concerning their personal appearance. Now, when you see a well-groomed conductor with a clearly defined crease down the center of each leg of his trousers, his coat and cap well brushed and his buttons shining, you will appreciate the fact that the Erie values smart looking men, and is prepared to pay something for what they want. There are said to be calls among the men for the introduction of this system on other parts of the line.

The Susquehanna Iron & Steel Company, of Columbia, Pa., is about to install an electric power distribution plant in its mills. A recent purchase from the Westinghouse Electric & Manufacturing Co. comprises a 400-kilowatt, alternating-current generator, one 200 horse-power induction motor, and 300 to 400 horse power in motors, ranging in size from 50 horse power to 20 horse power.

The famous New York Central engine 999, which, after being thoroughly overhauled, is now engaged in hauling Uncle Sam's fast mail on the Central, has been greatly pleased and very much flattered at the phenomenal sale of her picture, since we called attention last month to our transparent engraving of this typical "American" engine, shown in section with the correct mechanical name of every part given. We have been busy mailing these charts all over the country, and the demand keeps up. An idea of what her picture is like is given on advertising page 8 of this issue. Engine 999 is as popular as a foot-light favorite, though she may be more correctly styled a "headlight favorite."

The railroad companies using oil fuel in locomotives find that the extension front end is a disadvantage, and are shortening it to the length that prevailed before the extension front mania struck the country. Many coal burners would not suffer if their front ends were shortened by half.

One of our friends, Mr. J. B. Phillipps, a gang foreman in the Southern California shops at San Bernardino, has invented a variety of labor-saving tools which he has agreed to have illustrated in RAILWAY AND LOCOMOTIVE ENGINEERING.

Compound locomotives are more popular among enginemen on the Pacific coast than they are anywhere else where we had the means of noting unbiased opinions. It is a common thing for engineers to make requests for compounds in preference to simple engines.

The Evansville & Terre Haute Railroad have recently ordered three consolidation engines from the Baldwin Locomotive Works, in Philadelphia. This road has received two Atlantic type passenger engines from the American Locomotive Company.

Air-Brake Department.

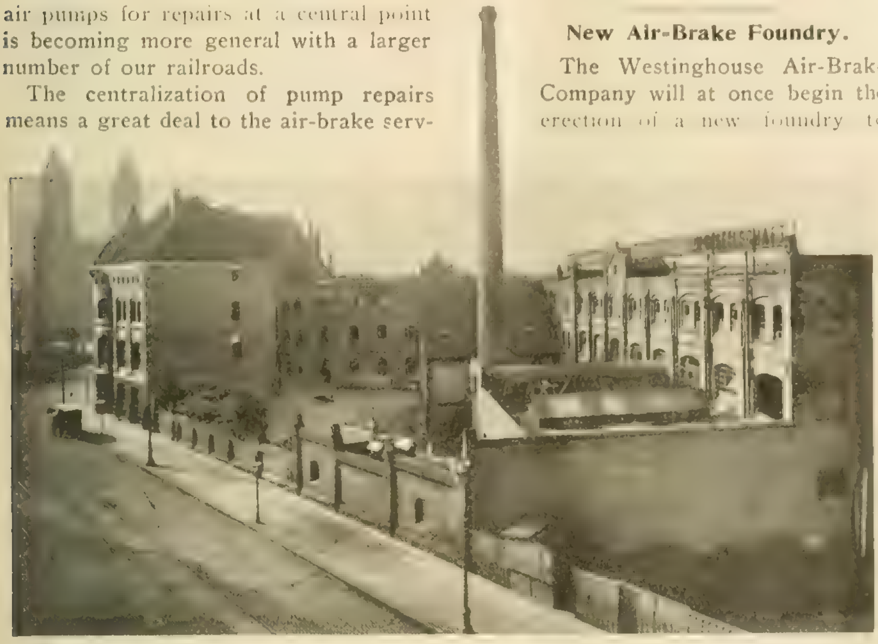
CONDUCTED BY F. M. NELLIS.

Air-Pump Repairs.

The good practice of assembling all air pumps for repairs at a central point is becoming more general with a larger number of our railroads.

The centralization of pump repairs means a great deal to the air-brake service. It means that when repairs are once made on a pump, at a specially centralized point, it may be taken for granted that the work is quite well done. Whereas, if the work be done in the round house in running repair fashion, it must be hurriedly done in order to permit the engine to keep moving, and the consequence is that the work will be done by a general utility man and the work will most probably be slighted. A few such repairs as this returns the pump to the round house after a very short term of service. A repetition of such loose repairs just mentioned soon places the pump in a general bad condition, in which a malrge number of repairs have been made, and each one quickly and slightingly done. The pump is a victim of numerous doses of bad medicine. The result is that instead of really improving, the pump grows weaker and weaker until it finally gives up the ghost in a bad air-pump failure.

The advantage of back shop repairs, where air-pump work is centralized, special and efficient workmen are employed, and after repairing the pumps their work is carefully tested. The latter system of repairs will do much toward greatly and permanently improving the air-brake service. It is a noticeable fact that many pumps repaired on engines in round houses soon return for other repairs, which seem to grow out of the first repairs.



WESTINGHOUSE AIR BRAKE COMPANY'S WORKS, HANOVER, GERMANY

New Air-Brake Foundry.

The Westinghouse Air-Brake Company will at once begin the erection of a new foundry to be 320 feet long by 65 feet wide, and constructed of brick with steel frame. This foundry will be located just west of the present air-brake works at Wilmerding, and has been made necessary by the greatly increased demand for castings used in the apparatus manufactured by this company. Owing to the development of the traction brake business, the Air-Brake Company's present foundry facilities have been overtaxed for some time past, and in order to insure a greater efficiency in production and prompt delivery of material, it has become necessary to provide greater capacity. This addition to the plant will materially increase the Brake Company's working force, now numbering about 3,000 men, the majority of whom reside in Wilmerding and vicinity.

WESTINGHOUSE AIR BRAKE COMPANY'S WORKS, LONDON ENGLAND

1902 Model New York Engineers' Brake Valve.

The accompanying figures illustrate the improved New York Engineers' Brake Valve, which is known as the 1902 model. This valve retains in its construction all the essential features of its predecessor, known as the Vaughn-McKee brake valve, and it possesses in addition several modifications of the working parts, which make it completely automatic.

It will be observed from the figures that the valve consists of a main slide valve 114-A; a handle to move the main slide valve; a seat for the main slide valve, shown in Fig. 1; a piston 104-A; a lever 112; a small cut-off valve 110, an excess pressure valve 97, and a cover 115-A, and a body 101-A, to enclose these parts.

The modifications consist principally of a change in the shape of port *J*, in the main slide valve, and the addition of a tee-shaped cavity *P* to the face of this valve, as shown in Fig. 2; of a port and passage *O*, which begins in the center of the back cap 102-A, Fig. 3, passes up through the back cap, then through the valve body 101-A, into and along through the valve cover 115-A, Fig. 4,

to the point marked *O* in plan of valve seat, Fig. 1; then it re-enters valve body 101-A, and ends in the seat of main slide valve 114-A; of a vent valve 180, Fig. 3, attached to the stem of piston 104-A, by means of a combined follower nut and cage, which controls passage *O*, when the piston is in the position

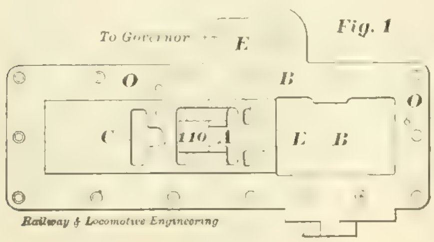


Fig. 1

shown; and of a ball-check valve 184 held in a cage formed in a boss on the front of piston 104-A. The purpose of these modifications is to locate automatically piston 104-A in its proper position regardless of the method employed in handling the brake valve, and to charge the supplementary reservoir through the small port in piston 104-A, controlled by check valve 184, instead of through passage *H*, as is done in the older Vaughn-McKee brake valve.

At passage *H* there is a pipe connect-

Face of Slide Valve

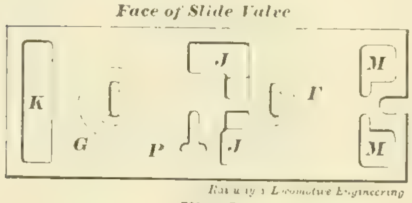


Fig. 2

ing a small receptacle, known as the supplementary reservoir, to the brake valve. The supplementary reservoir may have any convenient location in the cab, provided only that it is somewhat higher than the location of the brake valve itself, and its function is to enlarge chamber *D*, behind piston 104-A, and to hold sufficient air to expand behind this piston, and move it the proper distance forward in service applications. The positions of the different valves and their relations to one another when the valve is being operated, is shown in Figs. 5, 6, 7, 8, 9 and 10. (Six views showing release, running service, positive lap, automatic lap and emergency positions.)

In Fig. 5 the handle of the brake valve is shown in the extreme forward position. In this position (release) the rear edge of main slide valve 114-A, uncovers port *A* in the seat. Through port *A* the main reservoir air may flow freely into the train pipe to raise up quickly the pressure therein, thus releasing the brakes promptly and quickly recharging the auxiliary reservoirs.

The running position is shown in Fig. 6. Here the main slide valve 114-A covers port *A* in its seat, and the main reservoir air flows to the train pipe by way of the excess-pressure valve 97, not shown in this figure, but shown in Fig. 4. In this position excess pressure is obtained in the main reservoir, the amount of excess obtained depending solely on the tension of the excess pressure spring. Referring to Fig. 4, which is a cross-section through the excess-pressure valve, it will be observed that this valve is constructed similar to a steam pop valve; that is, there is a flange, or projection, on it so that when it lifts from its seat the air may impinge upon this flange, and thus raise the valve higher from its seat, and permit a faster feeding up of the train pipe.

Positive lap position is shown in Fig. 7, and when the handle is in this position all communication between the main reservoir and the train pipe, and also between the train pipe and the atmosphere is cut off, or, in other words, in positive lap position, the valve prevents the flow of air in any direction through it.

In the service application, Fig. 8, main slide valve, 114-A, is moved back until port *F*, in its face, is uncovered, and port *O* in the seat is covered and port *G*, which communicates with port *F*, is brought over exhaust port *C*, which leads to the atmosphere. The service application position is shown in Fig. 8, and the arrows indicate the course the train pipe air takes in flowing to the atmosphere.

The air in the supplementary reservoir and chamber *D*, on account of port *O* being blanked and the passage through the piston 104-A being blocked by valve 184, will now expand and push piston 104-A forward as fast as the pressure falls in chamber *A* (train pipe) in front of it, until the small cut-off valve 110, through the medium of the lever 112, is moved far enough to cover port *F* again, and so prevent further reduction in train

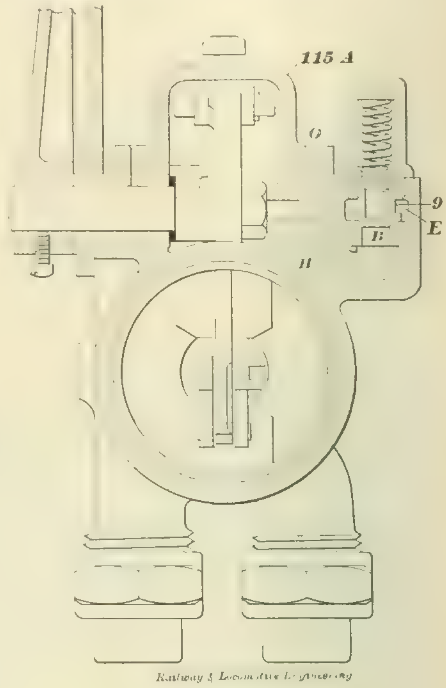


Fig. 4.

pipe pressure. The valve when lapping port *F* in this way is said to lap automatically, and the location of all parts in this positions is shown in Fig. 9.

In all cases of emergency, the handle of the brake valve should be moved to the emergency position as shown in Fig. 10. Train pipe air leaving chamber *A* passes out through port *J*, shown in Fig. 10, and port *K*, which communicates with port *J* by means of a passage through the main slide valve connecting

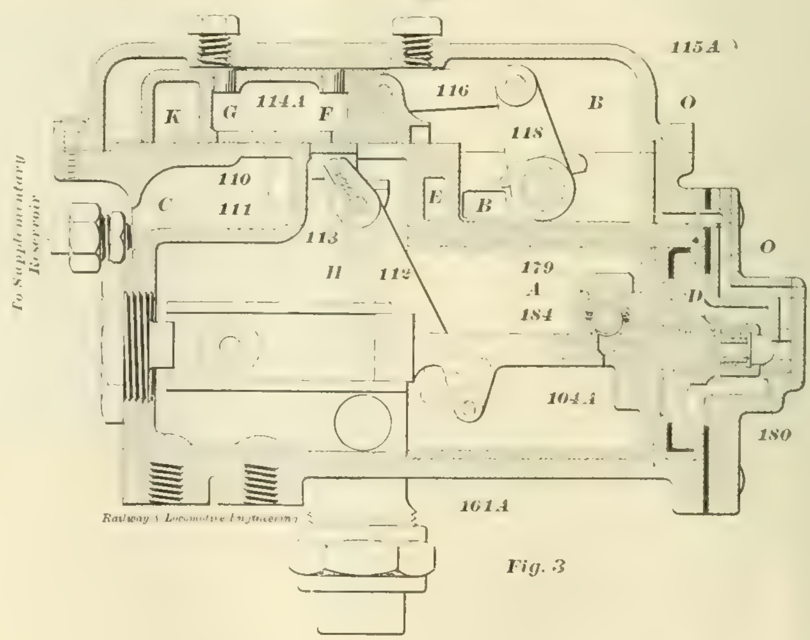


Fig. 3

these two ports, and the exhaust port *C* to the atmosphere. These ports are made large purposely so that train pipe air may flow freely to the atmosphere

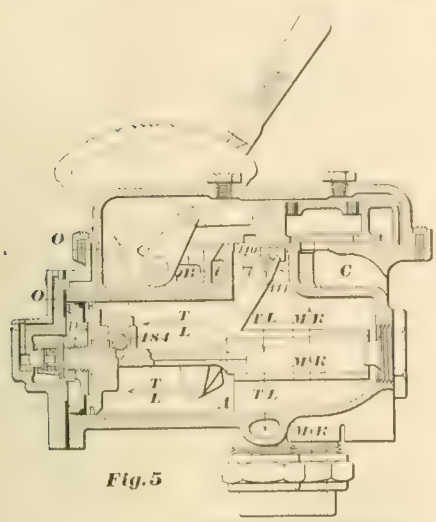
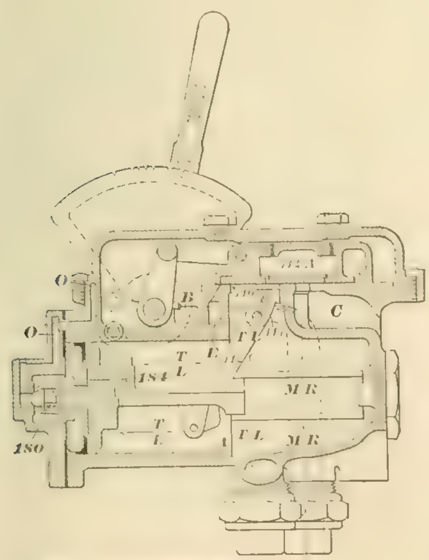


Fig.5

Railway & Locomotive Engineering

when the handle is in emergency position, in order that a sufficiently quick and sudden reduction in train pipe pressure may be had with which to start the quick-action parts of the triple valves into operation.

Mr. M. LaQuay, until recently air-brake inspector on the Chicago & Alton R. R., has accepted a position with the New York Air Brake Co.



Railway & Locomotive Engineering

Fig. 6.

Lowest, Most; Highest, Least.

I send you a sketch of steam pipe connections to pump testing rack at Stratford Shops of the Grand Trunk Railway. The 2-inch steam main is perpendicular. Will the lubricator, placed at *A*, lubricate all three pumps equally?

ROBERT L. STAMP.

Stratford, Canada.

QUESTIONS AND ANSWERS

On Air-Brake Subjects.

---

(35) J. P. P., Highbridge, N. Y., asks:

What brakes are to be used on the underground cars when that road is completed in New York city? A.—The Westinghouse quick-action automatic air brakes.

(36) E. R. G., Kalispell, Mont., asks:

How much more time will it require to charge, say a 40-car train of air, at an altitude of 5,300 feet than at an altitude of 2,900 feet? This means, of course, from nothing to 70 pounds. A.—About 40 seconds.

(37) P. J. F., Oelwein, Iowa, asks:

Why do you not put a cut-out cock in the driver brake pipe to each cylinder, so that one cylinder can be used if the

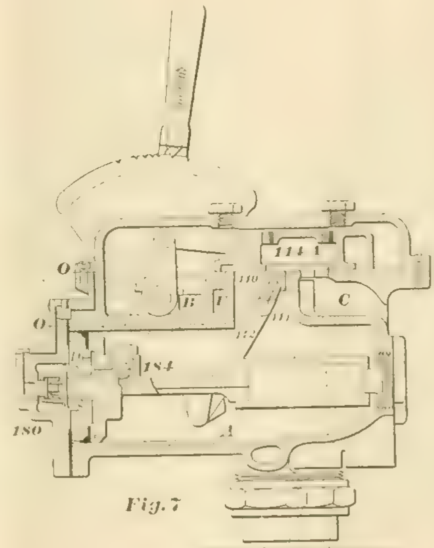


Fig.7

Railway & Locomotive Engineering

other gets out of order? A.—It is not good practice to attempt to use one driver-brake cylinder if the other should become defective or faulty, as this would throw uneven strains on the side rods of the engine, and if the wedges were not set up snugly, it might be the means of stripping one side.

(38) D. J. L., Burlington, Mo., asks:

How long does it take for the air to travel from the engine to the rear car on a 50-car train in releasing brakes? A.—The time would depend largely on the difference in pressures in the train pipe and main reservoir, and the capacity of the main reservoir. With a reservoir of about 25,000 cubic inches capacity and at a pressure of 90 pounds, if opened into a train pipe whose pressure was about 60 pounds, the time required for the wave of increased pressure to travel from the engine to the fiftieth car would be between 7 and 10 seconds.

(39) A. P., Newton, Sydney, New South Wales.

In the Improved Driver's Brake valve rotary, there is a small port drilled

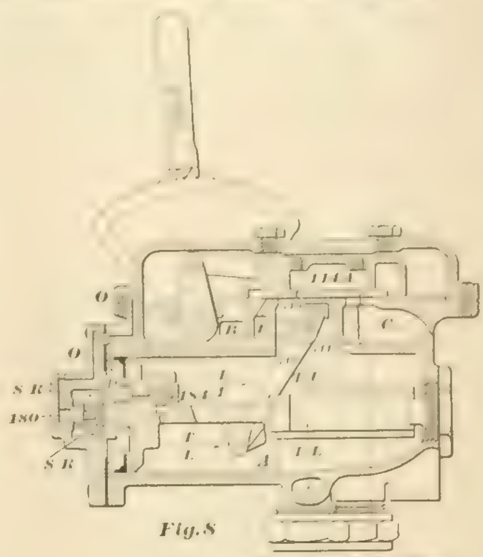


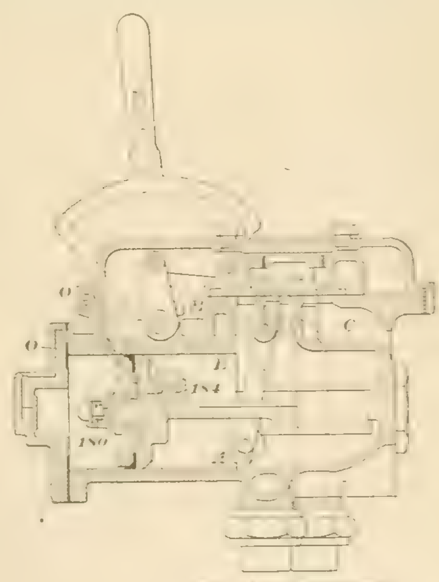
Fig.8

Railway & Locomotive Engineering

through, and situated about one inch to the right of the reserve pressure port, will you kindly say what the object of this port is for and its use? A.—This port is called the "warning port." Its object is to warn the engineer that the brake valve handle has been left in full release position, and should be returned to running position. In full release position this port permits main reservoir pressure to escape to the atmosphere, producing the warning sound.

(40) R. L. E., Elkhart, Ind., asks:

Why will not a retaining valve on the driver brake hold in the slack of the train when brakes are being released and



Railway & Locomotive Engineering

Fig. 9.

keep the train from breaking in two as well as the combined straight-air and automatic air brake? A.—Retaining valves

on locomotives, for holding in the slack of a long freight train when brakes are released, have not proven a success. A great fault is the fact that the leather packing in the driver brake cylinders leaks away the pressure, depriving the retainer of a chance to do its work, therefore rendering it inadequate and

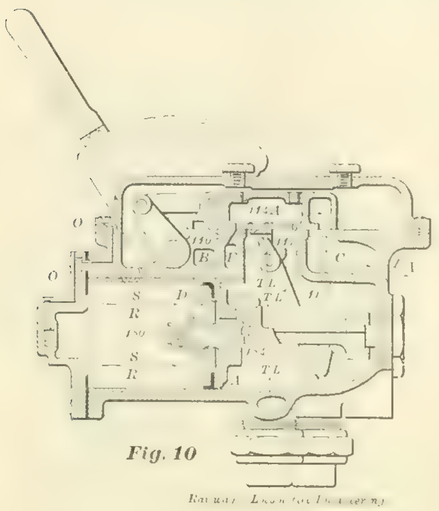


Fig. 10

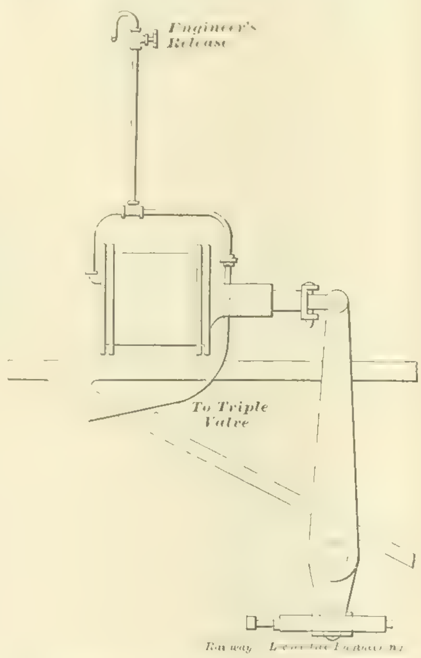
useless. The combined automatic and straight-air brake, when set straight air, to hold in the slack while brakes are being recharged, connects the main reservoir with the driver-brake cylinders, thus furnishing a large and constant air supply to these cylinders, keeping the brakes set regardless of any leakage in leather packings. The air pump is virtually pumping direct into the driving-brake cylinders.

(41) C. C. A., Scranton, Pa., writes:

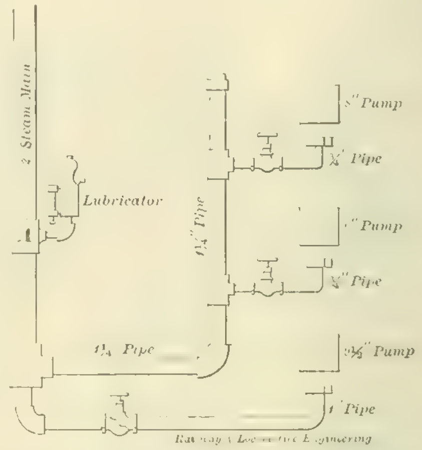
I am told that the air-brake pump used on locomotives is extravagant and costly in its use of steam. One engineer says the air pump uses as much steam as the engine cylinders do. A.—While the air-brake pump is extravagant in its use of steam, especially when based on the quantity used compared with other pumps and engines, it is far less extravagant in steam use than is the engineer above mentioned in his assertions. An eminent authority states that several times as much steam is required by the air-brake pump to compress a given volume of free air to a certain pressure as would be used by the most efficient modern compressor to do the same work. But then, air-brake pump service is peculiar. The pump uses steam mostly when the engine throttle is closed, standing at stations or drifting down grade, and when the safety valves would otherwise be blowing such steam away. Less steam used by the air pump would not, generally speaking, mean more steam for the locomotive cylinders, but more steam for the safety valves. Again, the air pump is very simple in its mechanism, and always ready for immediate service. This is not true of the most highly efficient air compressors.

(42) D. H. R., Syracuse, N. Y., writes:

What is the difference between a high pressure control system and the system which has the two governor tops, with one top connected to the under side of the brake valve that you illustrated in the February number? A.—The two systems are distinct and separate. The high pressure control is a device in which, by turning the reversing cock, a high pressure governor top and high pressure feed valve attachment may be cut in, and simultaneously a low pressure governor head and feed valve attachment be cut out. Likewise, by a reverse movement of the handle of this cock, the low pressure parts may be cut in and the high pressure parts be cut out. The high pressure parts will give pressures of 90 pounds in the train line and 110 pounds in the main reservoir. This high pressure feature is for trains whose cars are all loaded. On the other hand, the low pressure parts give 70 pounds in the train line and 90 pounds in the main reservoir, and is used to operate trains wholly made up of empty cars. The duplex high pressure main reservoir control apparatus is a device which merely permits the controlling of main reservoir pressure at about 20 pounds above the train line pressure (or maintains an excess of 20 pounds), while the brake valve handle is either in release or running position; but when the valve handle is placed on lap position, the pressure obtainable in the main reservoir is greater, because the low pressure governor head is cut out and the high pressure head cut in. Thus, on lap, the main reservoir may be pumped up to whatever the high pressure head is set for, and in running or full release position, the low pressure head will control. The advantage of this arrangement is that the pump will labor against a high main reservoir only while the brake valve is on lap, and an unusual high pressure will be thereby obtained to release and recharge brakes.



SILVENE'S DRIVER BRAKE RELEASE VALVE.



STEAM PIPE CONNECTIONS TO AIR PUMP TESTING PLANT.

CORRESPONDENCE.

Driver Brake Release Cock.

We are aware of the fact that brakes set and engine reversed is a dangerous practice. We lay ourselves liable to spot tires and get demerit marks; and, with wheels skidding, you will run by the mark or into something.

My solution of the problem is to have a pipe with a ¾ stop cock located in a convenient place in the cab and connected to the brake cylinder pipe, which we might term a quick release. Then, if your brake is not in good condition, and won't hold as much as you can with engine reversed, release your driving brake with the ¾ cock and reverse the engine.

You will find such a device handy to switch with where you have a large cylinder and small triple valve. Also, in conjunction with this have a retaining valve. The writer has both, and finds them to be very handy switching and also handling a train. B. McCloskey.

Louisville, Ky.

Driver Brake Release Valve.

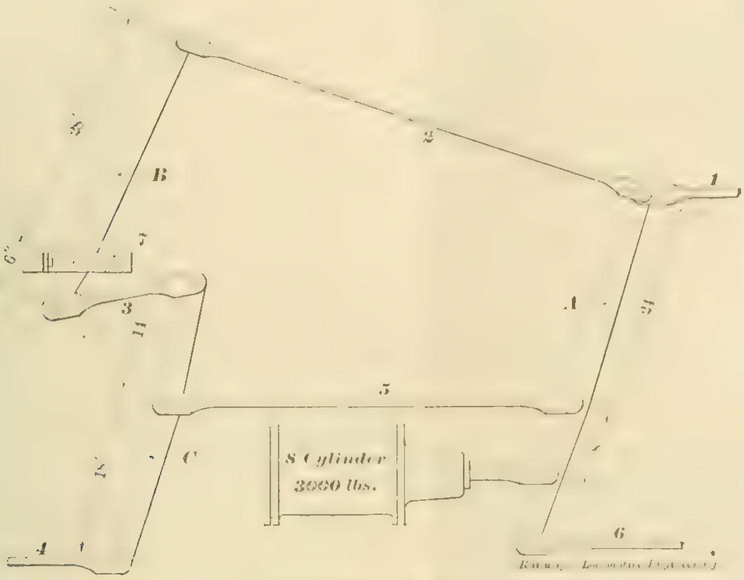
There appears in your paper of November issue, an article on the sliding of drivers with engine reversed. I am sending you a blue print of an apparatus used by myself for the past twelve years to overcome the sliding of driving wheels. This device acts as a kind of retaining valve by plugging up the exhaust port of the triple valve. By so doing, you make the driving brake independent from the train. If the engineer

does not want the air on the drivers he opens the globe valve and lets the air off, and still has the air brakes set on the train. Again, on long grades it becomes very handy, for he can let the air off his drivers and let the tires cool down.

I think this little device will help a good many engineers from getting into trouble from flatting or sliding driving wheels. If he wants to reverse the engine, all he has to do is to open this valve which lets the air off his drivers, and still he has the air on his train. If an engineer throws his engine over with the brake set, his drivers will start to slide, and he lets all the brakes off. I have seen an engine running at thirty miles an hour, without the air on her drivers, and by reversing her, the driving wheels will start to slide if the engineer doesn't give her steam.

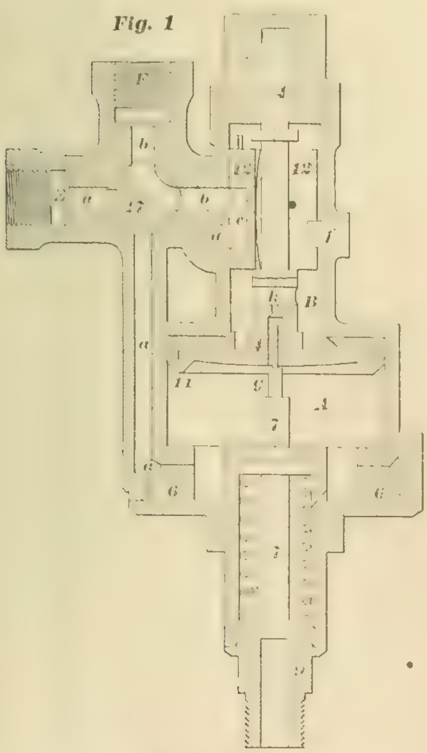
T. SILVENE.

Victoria, B. C.



A LEVERAGE PROBLEM

Fig. 1



OLD CENTER-FEED TRIPLE

Early Form of Triple Valve.

One of the first forms of all-metal triple valve is illustrated herewith. The section of this triple valve is also shown. As will be observed, the triple valve has no feed port in the bush as has the present form of triple, the feed of pressure from the train line side of the triple piston into the auxiliary reservoir being through the center of the trunk of the piston, in which is a "feed needle." This type of triple valve is commonly known as the "center feed," or "needle feed."

On the bottom of the triple is a large drain cup, much larger than seems necessary in common practice. This triple valve is also supplied with a device for disposing of train pipe leakage, which the modern leakage groove in the brake cylinder now takes care of. This little bit of air-brake history may be of interest to some readers.

AMOS JUDD.

Boston, Mass.

Soiling another will never make oneself clean.—*Tennyson.*

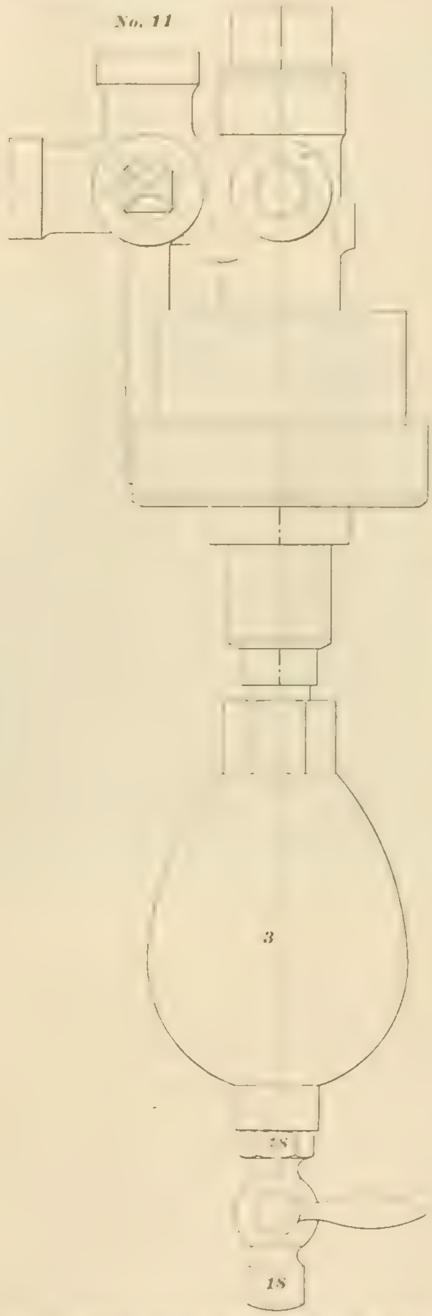
The Southern Pacific Company have a remarkably intelligent equipment of enginemen and the younger men ought to be afforded every facility for keeping themselves posted about the changes of mechanism coming into use all the time.

A Leverage Problem.

The sketch accompanying this letter was handed me by a friend, and I would like to have your idea as to its value. You see the idea is a system of levers for car braking, wherein the fulcrum of the levers are utilized as braking power, instead of being solid to the car body. I would like to have the opinion of other readers of the Magazine on this subject.

C. P. McGINNIS.

Chicago, Ill.



OLD CENTER-FEED TRIPLE VALVE WITH DRAIN CUP ATTACHMENT.

The Georgia Railway & Electric Company are building cars to be used in distributing light freight in and around Atlanta. That business is gaining favor with many street car companies and the prospects are that in the near future most of them will be engaged in it.

On to California. First Section. Over the Lackawanna.

BY ANGUS SINCLAIR.

The doctor said that the raw, damp winds which circulate around New York in February and March accentuated the infirmities of age and enabled rheumatism to twist around its most excruciating screws. "You must go to a milder climate," positively asserted the disciple of Esculapius, and I suggested Florida. Florida is too near your office was the next opinion, you would be back every week. Go to California. The doctor's advice was seconded by others who wield influence in my affairs, and that is how I decided to visit California.

The journey of nearly 3,200 miles fróm New York to Los Angeles does not give the sudden transformation from winter to summer that a traveler goes through in the brief run into Florida, but the experience is a much more interesting one and compels the traveler to see a long stretch of most varied country, which impresses every observant person with the vast possibilities of the United States for the support of an enormously increased population.

Our entire outward journey took the party over the Lackawanna, the Nickel Plate and the Santa Fé lines. They all have charms all their own, and during the five days of the journey there were attractions enough to make every mile of the way marked with a white stone, engraving impressions that become a lifetime heritage.

In ancient lore mention is made of a great man endowed with the gift of enjoying outward impressions. He had seen and heard many beautiful things, and misfortune having come, he exclaimed in the midst of disaster, "I have enjoyed great happiness and seen many wonderful things, and even the wrath of the gods cannot take away the pleasure that memory brings." Those who enjoy the pleasures of travel too seldom thoroughly appreciate the privileges coming to them. When a man spends seven or eight hours a day in a sleeping car playing solitaire, and when a woman keeps plunged all day long into the recesses of dime novels, the natural inference is that the principal advantages they enjoy from travel is telling friends where they have been and what lovely scenes they have seen—in the photographs.

A trip over the Lackawanna is a good introduction to people starting out with the expectation of deriving much enjoyment from what is to be seen in the Rocky, the Sierra Nevada and other mountains, with all the varying scenes of flood and field, that are always striking as surroundings wherever mountains rear their heads above the clouds.

PICTURESQUE LACKAWANNA.

We are no sooner away from Hoboken than we begin to see things that would excite great interest among strangers, more especially among foreign travelers. The journey away from the Hudson seems to be interdicted by nature in the shape of a high ridge of basalt rock, which we pass through in a tunnel from which we emerge upon the far-famed Jersey meadows. Meadows by courtesy, but marshes in fact, noted for the quantity of mosquitoes raised annually, and they in their turn for their ferocity. I have traveled in many lands, and I have made the acquaintance of many mosquitoes, but none had the depths and endurance of sting possessed by the Jersey breed.

Eight miles out we pass through Newark, one of the oldest cities in the Union, with nearly 250,000 inhabitants, having the greatest variety of industries of any city in the United States, and known by name to less than one per cent. of the country's inhabitants; a famous town unknown to fame through its proximity to New York city, the greater overshadowing the less.

We are speeding through the Oranges on a plateau which, three miles from tide water, is 200 feet above the sea, and has homes for 60,000 people suburban to New York. We are climbing the Orange "mountains," which would be regarded as low hills by people raised out of Holland; but the Dutch who first made settlements in this district, and had never previously seen anything higher than a windmill, looked with awe upon the altitude of these hills, rising 500 feet above the surrounding valleys. Although the hill scenery here is not majestic, it is highly picturesque, covered as it is by beautiful trees and foliage of every hue.

In the rolling plains near these hills many minor fights took place during the War of Independence. We are thinking of them when Morristown is reached, where Washington had his army encamped during the winter of 1777. The surrounding country is noted for the number of Washington headquarters. Every tumble-down dwelling is reputed to have sheltered "the father of his country" at some time.

We are now in a country that in a charming manner combines the scenic and the utilitarian. Attractive scenery graces fertile farms, handsome residences appear to rush past us every few rods, and presently we see signs of manufacturing industry.

Since Mr. Truesdale became president of the Lackawanna he has pursued the policy of encouraging and fostering industries. This policy was carried out with intelligent discrimination, for no industry was encouraged to settle in a place unless the conditions were likely to promote success. A booklet published by the company on industrial opportunities says:

"The aim of the railroad is not alone to secure the location of industries, but to secure locations under the most favorable conditions with respect to raw materials, the most available power, the class of labor required, the market for the product and the innumerable other conditions which have their bearing upon the production of manufactured goods at a profit."

The first manufacturing town of any importance reached by the Morristown route is Dover.

When the history of the older industrial centers in the United States is studied, we often find that the original nucleus was a mill of some sort, or a "forge," which people of British birth would call a smithy. This was altogether different from the origin of European towns. Most of them originated with the building of a church or a castle.

These were towers of strength, and houses gradually grew under their wings like chickens under their mother's protecting cover. The origin of European and of American towns was characteristic. One needed the protection of religious grandees or of a powerful baron; but all that the pioneer American needed was the proximity to an established peaceful industry.

I had almost forgotten Dover, N. J. It originated from a forge, and has a variety of manufactures, mostly of metal, and is beautifully situated on the highest position occupied by any city in New Jersey.

All along the line we find at nearly every station signs of industrial operations of some kind, most of them in their infancy, but at other places considerable progress has been made, and Scranton is one of the greatest manufacturing cities in the United States. Other towns, such as Elmira, Binghamton, Corning, Stroudsburg, Danville and Owego, produce a volume of manufactures which provide good business for the railroad.

The principal carrying business of the road, however, is anthracite coal, large quantities of it being mined in the neighborhood of the track. To those who suffered last winter from want of coal, the long sidings full of coal cars loaded over the brim, was a nerve inspiring sight.

At some of the stopping places where coal loaded cars appeared to be as numerous as the sands of the sea. I noticed the eyes of some of the passengers glistened as they looked on with fond longing, and I knew that they were among the unfortunates who failed to put in their winter supply last summer.

There is one feature about the Lackawanna route which is unique. The wayside is perforated with coal pits, and nearly all the manufacturing towns produce iron products; yet there is a clear sky all the way untainted by smoke. To one who has gone through the "Black Countries" of England, France and Germany, where the beauties of nature are blotted out by smoke and its products, the difference is remarkably striking. Where ugliness is artificially produced, it exerts a baneful effect upon the human beings who are compelled to dwell amidst such surroundings; and they are slovenly and dirty, with meager pride in personal appearance. In all my travels in the Pennsylvania coal and metallurgical regions, I have never seen displayed the affinity to filth and squalor so common in similar regions in Europe.

I do not seem to be making much progress with our journey, but whilst I have been thinking of such things, the train has been speeding along, has rounded glorious showing-off curves by the Delaware river, has shot through the Delaware Water Gap and is now climbing Pocono mountain. That meant that we had been passing through some of the favorite pleasure, health and pastime resorts that tired New York uses for recuperating waste of vital energy. Upon the retina of my mind was printed masses of gigantic rocks softened by environments of green foliage and verdure, standing like a mighty rampart to protect the waters of a crystal river, rushing with relentless force toward their peaceful haven, the cold blue ocean; green peaceful meadows, where sweet-breathed kine lazily waded through beds of wild flowers; hillsides where spreading trees seemed to rival each other in producing its own fairest tint of green, which seemed to vary from blue to shaded white, making a continued canopy of greens varied as the trees themselves. There are pictures of black-watered canals where long barges were moving with weary pace, the Past lagging away behind the Present. And there were lakes and swamps and brooks with rushing waters that suggested trout, and buildings for storing ice fruit, and burned woods and desolated land crying loudly like the voice in the desert for the planting of trees, that the nakedness of its bosom might be hidden, and as we recover consciousness we are climbing Pocono mountain, as the toiling engine plainly proclaims to our ears.

PICTURESQUE LACKAWANNA.

Pocono mountain is not so awfully high after all, being 1,900 feet above sea level; but everybody connected with the Lackawanna system is proud of it, and swears by it, and I strive to enthuse through sympathy. But no effort was needed for enthusiasm, when I rode on the engine, one time, and suddenly beheld the vision of a splendid valley beneath with Scranton apparently at our feet, although 31 miles of twisting and twining had to be accomplished before the city was reached. I have been on the tops of many mountains, but I have seldom seen such a striking sight as one beholds from Pocono. Now ye men of Lackawanna receive me as a brother.

Although culm heaps are too much in evidence about Scranton, the town is beautifully situated and has a most striking appearance in the distance. But Scranton is in itself a stern reality, a town with hollow coal mines extending beneath like huge catacombs, while all sorts of activities reign above the ground. Whatever can be made from the ores of iron is be found here under manipulation, mostly in the rough. There are steel rail mills, engine building works that embrace locomotives and a variety of other industries that give work of a lighter vein to willing hands, such as silk making and piano making, to say nothing of the great establishment which houses the International Correspondence Schools.

After leaving Scranton the route seldom touches a wild country such as was encountered in the first part of the journey. The scenery is never tame, but the track passes through a great deal of fine agricultural country with rolling swells and numerous valleys protected by aspiring ridges. The traveler who enjoys looking at nature dressed in its most attractive robes, will have no inclination for reading or for playing cards while passing over any part of the Lackawanna system.

The company provides everything in reason for the comfort of passengers. Since Mr. Truesdale was elected president in 1899 the road has been practically rebuilt. The roadbed and track have been improved upon the most modern lines, new bridges have substituted all the old ones that were too light for

80-ton engines and 50-ton cars. Curves have been straightened out, grades have been cut down and a modern system of automatic block signals has been extended from New York to Buffalo.

The first-class condition of the rolling stock is particularly noticeable, locomotives have the appearance of being thoroughly cared for and the cars are clean, airy and ride splendidly. There is no smoke, no dust, and the cars are so well ventilated that no request is ever heard for open windows.

The dining-car service is remarkably well managed on the restaurant plan, and gives entire satisfaction to the patrons of the road. After dinner I retired to the smoking room for a taste of the soothing weed and to glean the views of my fellow travelers. The place was unusually crowded. If Mr. Lee had hired a corps of travelers to praise the Lackawanna management, they could not have talked more enthusiastically about the attractions of the road and the comforts of the train service. On ocean liners, in hotels and in Pullman cars, I have always found that the smoking room habitués have correct knowledge about the management of steamers, hotels and railroad trains. The smoking room opinion thoroughly endorsed the management of the Lackawanna and their views coincided with my own in every particular.

PICTURESQUE LACKAWANNA

Book Review.

Gas, Gasoline and Oil Engines, by Gardner D. Hiscox, M.E. Publishers, Norman W. Henley & Company, New York, 1902. Price, $2.50.

Mr. Hiscox's work on Gas, Gasoline and Oil Engines is now in its tenth edition, it contains 391 pages of reading matter, and has 312 illustrations. It is what it claims to be, an up-to-date work on the subject. It deals with explosive motors for all purposes, and is complete in its treatment of theory, practical details and operation of these types of engines. Illustrations of parts, together with tabulated sizes of explosive motors for stationary, marine or vehicle power, are given, followed by notes on the care and management of these machines. Electric ignition by induction coil and jump spark are fully explained and illustrated with notes on testing for economy and power, and the erection and installation of power plants.

The book has a comprehensive index and gives a list of patents issued in the United States for gas, gasoline and oil engines and their appliances from 1875 to July 1, 1902, inclusive. The book is intended to afford information to every one interested in this kind of motive power. It treats of the theory and practice of these engines as designed and manufactured in this country.

Not that Kind of Sand.

A four-year-old boy of the question-asking breed was visiting San Diego Mission with his mother. Mamma, remarked the boy, this is an awful sandy place, is that why it's called Sandyago?

Hush, said the mother, don't talk so much. It's not that kind of sand that's meant.

Our old friend Mr. Geo. L. Weiss is one of the incorporators of the Cleveland Car Specialty Company, which will manufacture and deal in devices for passenger and freight cars. Mr. Weiss may be depended upon to give vim to the company.

English and American Loading Gauges.

The "Decapod" suburban engine designed by Mr. Holden, locomotive superintendent of the Great Eastern, is said to be the largest engine ever built in England, and the first one to have five pairs of coupled wheels. This engine was illustrated in RAILWAY AND LOCOMOTIVE ENGINEERING last month. It is built about as close to the English load line as can be. British designers, in gaining greater efficiency by increasing the size of the boilers of their engines, have been compelled to sacrifice something of the artistic appearance which has hitherto been one of the striking features of their machines.

It is stated that a type of car built for one of the tube railways of London will have a novel form of construction. A trailer car has been built for the City & South London Railway with the platform at either end attached to the truck. The object of this is to permit the platforms to swing with the truck, so that in rounding curves the platforms will not project over one rail, as they otherwise would. Any one who has noticed an ordinary street car going round a curve in a city like New York must have noticed that the projecting basket fender, if it has one, projects out into the roadway so as to hardly cover the outer rail. A person in the center of the track would not be touched by the fender at all. There will not be any fenders on the English cars or people crossing the track of the tube railway, but this illustration serves to show what the designer has in mind in attaching a platform to a truck.

Boring mills are not generally employed to cut piston rings out of the casting, but they can be made to do that work when the pinch of necessity is the mother of invention. Mr. C. W. Werst, general foreman of the Southern California shops, found that he did not have enough lathes to turn the piston rings in demand, so he enlisted the boring mill. It bores and turns the blank in one operation and then the work of cutting off the rings takes very little time.

In the Southern California shops at San Bernardino they forge the piston head of steam-hammer pistons solid on the rod. This practice is becoming general in railroad shops and it deserves to be universal for broken steam-hammer pistons are very common and cause troublesome delays.

The use of babbitted or brass-lined eccentric straps is becoming almost universal with heavy modern locomotives.

Of Personal Interest.

Mr. A. Gordon Jones has been appointed assistant to the general superintendent of the Southern Railway.

Mr. J. E. Chisholm is appointed general shop foreman of the Chicago Great Western, vice Mr. R. M. Crosby, promoted.

Mr. Charles Mosler has been appointed foreman of the boiler shop on the Evansville & Terre Haute Railway at Evansville, Ind.

Mr. W. W. McCormick has been appointed trainmaster on the Great Northern Railway, vice Mr. C. M. Bryant, assigned to other duties.

Mr. W. K. McCoy has been appointed trainmaster of the Adirondack Division of the New York Central, with headquarters at Utica, N. Y.

Mr. E. V. Brogan, formerly chief dispatcher of the L. S. & M. S. R. R., has been promoted to the office of trainmaster of the Buffalo Division.

Mr. Harry A. Norton, of Boston, Mass., sailed last month for Russia, where the Norton Ball-Bearing Jacks are now being extensively introduced.

Mr. R. M. Crosby has been appointed master mechanic of the Oelwein Terminal, in charge of shops, round house and car yard of the Chicago Great Western.

Mr. W. A. Vaughan has been appointed assistant to the general superintendent of the Southern Railway, with headquarters at Chattanooga, Tenn.

Mr. Wm. Bennett has been appointed superintendent of the Wisconsin Division of the Chicago, St. Paul, Minneapolis & Omaha Railway, vice Mr. Winter, promoted.

Mr. Arthur W. Trenholm has been appointed general manager of the Chicago, St. Paul, Minneapolis & Omaha Railway, in place of Mr. W. A. Scott, deceased.

Mr. W. T. Kuhn, general foreman of the Lake Shore locomotive shops, has been promoted to the position of master mechanic of the Lake Erie & Western Railroad.

Mr. Wallace C. Winter has been appointed general superintendent of the Chicago, St. Paul, Minneapolis & Omaha Railway, vice Mr. Trenholm, promoted.

Mr. Thomas A. Walker has been appointed round-house foreman on the Evansville & Terre Haute Railroad at Evansville, Ind., vice Mr. C. W. Hyde, transferred.

Mr. Walter Maloy, formerly train dispatcher on the Chicago, St. Paul, Minneapolis & Omaha, has been appointed assistant chief train dispatcher, vice Mr. Nicoles, promoted.

Mr. Frank E. Nicoles has been appointed assistant superintendent of the Wisconsin Division of the Chicago, St. Paul, Minneapolis & Omaha Railway, vice Mr. Bennett, promoted.

Mr. T. J. Foley, heretofore assistant to the general manager of the Baltimore & Ohio, has been appointed superintendent of the Chicago Division, vice Mr. W. C. Loree, promoted.

Mr. Willard Kells has been appointed assistant master car builder of the Union Tank Line Company, with office at 26 Broadway, New York. Mr. C. A. Smith, consulting engineer, has retired.

Mr. C. O. Jenks has been appointed assistant superintendent of the Eastern Division, with jurisdiction over Second District, Great Northern Railway, with headquarters at West Superior, Wis.

Mr. R. A. McCandless has been appointed assistant superintendent of the Dakota Division of the Great Northern Railway, with headquarters at Larimore, N. D., vice Mr. C. O. Jenks, transferred.

Mr. Charles W. Hyde, formerly roundhouse foreman on the Evansville & Terre Haute Railroad at Evansville, Ind., has been transferred to a similar position on the same road at Terre Haute, Ind.

Mr. W. C. Loree, superintendent of the Chicago Division of the Baltimore & Ohio, has been appointed general superintendent at Pittsburg, Pa., vice I. G. Rawn resigned, to accept service on the Illinois Central.

Mr. Owen Owen, master mechanic of the Colorado Springs & Cripple Creek District Railway, has been given charge of the electric as well as the steam lines. He will have charge of the power plants and all electric equipment.

Mr. C. W. King, trainmaster of the Colorado Springs & Cripple Creek District Railway, has had his jurisdiction extended over the entire system, including steam and electric lines. He has also been appointed car accountant.

Mr. H. B. Hunt has been appointed assistant to the general manager of the Erie. Mr. Hunt was formerly a mechanical engineer on the Erie, and was stationed at Meadville. It is understood that he will have charge of the engineering department in the general manager's office.

Mr. James E. Simons, formerly connected with the Pittsburgh Coal Company, and more recently with the Hunt Foundry and Machine Company, has accepted the position of general manager of the O. M. Edwards Company, of Syracuse, N. Y.

Mr. C. A. Beck, formerly of the 'Frisco system at Cape Girardeau, Mo., has been appointed chief clerk and secretary to Mr. T. A. Lawes, superintendent of motive power of the Chicago & Eastern Illinois Railroad at Danville, Ill., vice Mr. F. L. Davies, resigned.

Mr. Edgar N. Smith, formerly roadmaster on the B. & M. R. Railroad, in Nebraska, and previous to that on the N. Y., N. H. & H. and the Boston Elevated, has accepted a position with the Railway Appliances Company, giving his time particularly to the Q and C-Bonzano Rail Joint.

Mr. C. C. Murray has accepted service with the Railway Appliances Company, with headquarters at Pittsburg, Pa., giving his time more particularly to the sale of the Q. & C. pneumatic tools. Last month the printer made us say it was some one else. Mr. Murray is the man, nevertheless.

Mr. A. B. Trenary, employed as passenger engineer, has been promoted to the position of road foreman of equipment of the Southern Division of the 'Frisco System. We understand that the superintendent of motive power has organized a staff of bright capable men for this branch of railroad work.

Mr. W. Cockfield has resigned his position with the National Iron & Steel Works, Mexico City, to become superintendent of machinery on the Inter-Oceanic Railway of Mexico. He takes the place of Mr. Louis Greaven, who has accepted the service with the Tehuantepec Railway as superintendent of machinery.

Mr. Frank L. Davies, chief clerk, motive power and machinery department of the Chicago & Eastern Illinois Railroad, and secretary to the superintendent of motive power of the road for the past eight years, at Danville, Ill., has been nominated for mayor of Danville. He has therefore resigned his position with the C. & E. I.

Mr. William Lauder, who has been foreman pattern-maker at the Montreal shops of the Canadian Pacific Railway for the last twenty years, has been one of the first to take advantage of the new pension system which has recently been put into operation on that road. Mr.

Lauder was presented on his retirement with a handsome wicker chair and a walking cane, by his fellow employees.

Mr. Thomas P. Egan, president of J. A. Fay & Egan Co., Cincinnati, Ohio, manufacturers of wood-working machinery, was one of the visitors at New Orleans at the National Association of Manufacturers' meeting last April. Mr. Egan was the organizer and first president of the association, and takes great pride in this distinction, as this body of men is most influential in the country.

Mr. J. P. Roesch, formerly traveling engineer on the Colorado & Southern Railway, has been appointed master mechanic on the Chicago & Alton, with headquarters at Slater, Mo. Mr. Roesch is well known to our readers through his numerous contributions to the pages of RAILWAY AND LOCOMOTIVE ENGINEERING. Those who were associated associated with Mr. Roesch in Colorado speak in the highest terms of his ability and popularity as a railroad official and predict that he will make a decided success as a master mechanic.

Mr. Archie M. Baird has been appointed agent to represent the Falls Hollow Staybolt Co. at Topeka, Kan., and that vicinity. Mr. Baird was formerly foreman boiler maker of the Santa Fe, at Topeka, and was the inventor of several pneumatic tools that are used in many railroad shops. He was also the pantentee of a double crown fire box. Mr. Baird learned his business in the Illinois Central shops at Chicago, was for a time foreman boiler maker of the B. E. R. & N. shops at Cedar Rapids, Ia., and had a wide experience in charge of boilers.

Mr. Lacey R. Johnson, assistant superintendent of rolling stock, Canadian Pacific Railway, Montreal, recently gave a lecture at Toronto Junction, under the auspices of the C. P. R. Club. Mr. Johnson described the whole transcontinental line from Montreal to Vancouver. Many of his hearers who had worked for years on one division of the road and only knew that one, were greatly interested in the lime-light views of distant parts of the line, which were shown. Lime-light views were also shown of the trip from Yokohama in Japan, where the C. P. R. steamships land passengers from Vancouver to Hong Kong, the British Island on the coast of China.

William Warren Card.

When the Westinghouse Air-Brake Company were pushing their great invention into popularity, one of the most active workers belonging to the company was General Sales Agent W. W. Card. His genial personality won for Mr. Card friends wherever he went pushing the interests of the air brake, and his capacity for making friends proved a powerful factor in overcoming the objections railroad men nearly always offer to the introduction of a new device. Hundreds of railroad men who met him in those days still remember Mr. Card with affectionate regard. The numerous friends he has all over this continent will be grieved to learn that his life was taken away on the 4th of last month, close to his own home, by a street car accident.

WILLIAM W. CARD.

William Warren Card was born in Nelson, N. Y., in 1831. His father was a civil engineer, and the son elected to follow his father's profession and was educated with that end in view. When only 19 years old, young Card went West and proceeded to make his way amidst the activities that were rapidly converting Ohio into a populous State. He engaged in whatever engineering work was most readily obtained, and like all earnest workers rapidly pushed to the front. His first regular railroad employment was on what was then called the Tuscarawas Valley & Wheeling Railway, where he rose to be superintendent and chief engineer. From there he went to the Panhandle as superintendent, and on that road he first met Mr. George Westinghouse, who was then struggling to introduce his air brake. Mr. Card had the engineering acumen to recognize the merits of the great invention, and at once co-operated in having trials made to demonstrate its value in controlling trains. It was on his division from Pittsburgh to Steubenville that the first train equipped with the Westinghouse Air Brake was put into regular service, and Mr. Card's intelligent interest did much to overcome the scruples of railroad men against favoring a device which was such a radical departure from anything hitherto tried.

Mr. Westinghouse, a remarkably good judge of men, was strongly attracted to Mr. Card and there seemed to be powerful mutual affinity between the two men. The result of their intercourse was, that Mr. Card entered the employ of the Westinghouse Air-Brake Company as general sales agent. It is doubtful if a better man could have been found in the country, for he had an influential standing among railroad officials, had a powerful personal magnetism, had the God-given faculty of making many friends and no enemies, and possessed the thorough knowledge of the brake's mechanism that enabled him to overcome all difficulties and to explain understandingly the details of the mechanism. He was not to Mr. Westinghouse what Boulton was to Watt, but he was a pillar of strength to the company in its struggling years, and an active zealous official until the day of his death.

Mr. Card was elected Secretary of the company in 1881 and held the office till last year when he was elected Second Vice-President.

The writer first met Mr. Card at the Exposition of Railway Appliances in Chicago in 1883, and a warm friendship was formed that never cooled. In the course of considerable social intercourse, I had very good opportunities of judging the man. In gladness and in sorrow he was ever the same big hearted gentleman, full of helpful plans for others less fortunate

than himself, and ever giving many people very good reasons to be thankful that W. W. Card had prospered in the world's goods.

Mr. Card was married twice, first in 1862 at Columbus, to Miss Hattie Dinsmore. In 1890 he wedded Miss Mary Llewellyn, of Pittsburg. He is survived by the widow and four children. The latter are W. D. Card, a Chicago business man, who is now on a tour around the world, having been last heard from in Japan; H. S. Card, a business man of Zanesville, O.; Mrs. Nellie Card Moore, widow of D. A. Moore, and Miss Ruth Card. A. S.

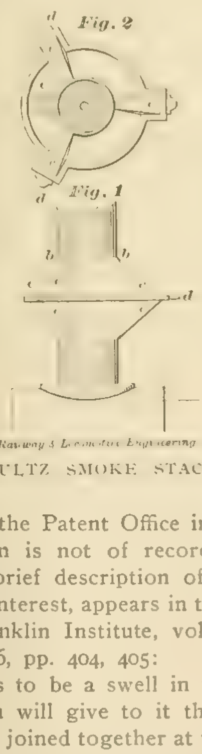
Mr. A. W. Horsey, chief draughtsman mechanical department, Canadian Pacific Railway, has gone to England and Germany on business for the company. His duties will be principally in connection with the inspecting of the engines now being built for the C. P. R. by the Saxon Engine Works, of Chemnitz, in Germany. Mr. Horsey will, while abroad, avail himself of the opportunity of visiting the different shops in that country. He will also incidentally visit the Hyde Park Locomotive Works in Glasgow, where the company are also having some engines built. There is, however, a regular inspector already there.

Mr. E. E. Clark, assistant secretary of the Department of Commerce and Labor, began life as a locomotive fireman. He was promoted for merit, and was head of the Order of Railroad Conductors, and one of the visiting labor leaders when President Roosevelt attended the convention of the Brotherhood of Locomotive Firemen at Chattanooga last year. On one occasion Mr. Clark made a brief but pithy address, to which the President listened. He was so much struck with Mr. Clark's ability that he subsequently appointed the labor chief as one of the Anthracite Coal Strike Commission. Mr. Clark justified the President's choice and has been appointed to office in the newly-created government department.

Mr. G. A. Bowers has recently been appointed master mechanic on the Southern Railway, with headquarters at Alexandria, Va. Mr. Bowers was born July 21, 1867, at Martinsburg, W. V.; he graduated from the high school at Martinsburg, W. Va., in 1883, and the same year was taken on in the B. & O. shops as machinist apprentice, and served the full term of four years, and in 1887 was accorded a diploma, ranking first in machinist examination. In 1896 he was appointed night foreman of the Western Maryland R. R. shops, with headquarters at Hagerstown, Md.; in 1897 was appointed general round house foreman; in 1898 resigned that appointment to accept as position as assistant chief engineer at the Maryland University Hospital, Baltimore, Md., and after eight months' service resigned to accept a position as assistant general foreman of the shops of the B. & O. R. R., with headquarters at Hyndman, Pa. He remained there two years when he was appointed master mechanic of the Baltimore & Annapolis Short lines, and Annapolis, Washington & Baltimore R. R. Co., at Annapolis, Md., and was there until January 15, 1903, when he accepted a position as general engine inspector of the Southern Railway, and on March 1 he was promoted to the position which he now holds.

History of Smoke Stack Described by Mr. W. de Sanno.

Supplementing Mr. W. de Sanno's description and illustrations of the old Philadelphia & Columbia R. R. stack in your April issue, I would say that it was known as the "Shultz" stack, and originated with William Shultz, who was, I think, master mechanic of that road in its early days, and was patented by him March 31, 1836, as will appear by reference to a copy of the patent drawing, which I send you herewith. As this patent, with many others, was destroyed in



SHULTZ SMOKE STACK.

the fire at the Patent Office in 1836, the specification is not of record, but the following brief description of it, which may be of interest, appears in the Journal of the Franklin Institute, vol. 18, New Series, 1836, pp. 404, 405:

"There is to be a swell in the smoke pipe, which will give to it the form of two funnels joined together at their rims; and across this wide junction there is to be wire gauze stretched, the enlargement being intended to prevent any obstruction in the draught. The pipe for waste steam is to perforate the sheet of wire gauze, which is secured to it by a flanch. Flues, which may be opened when the engine is at rest, are to pass on the outside of the conical enlargements, allowing a free draught; these are to be closed by valves, when the engine is in motion."

Claim. "What I claim is the whole arrangement, as hereinbefore described, without any connection with any other machine heretofore constructed for the same purposes."

I remember, as a boy, seeing many of these stacks on the Columbia road, but never saw them anywhere else. It may, however, have been used on the engines built by Harrison, Winans & Eastwick for the Russian Government, in 1844 and thereafter, as a stack of substantially the same external appearance is shown in the illustrations of their freight and passenger engines, which appear, facing pages 52 and 58, respectively, of "The Locomotive Engine and Philadelphia's Share in its Early Improvements," by Joseph Harrison, Jr., Philadelphia, 1872.

J. Snowden Bell.

Pittsburgh, April 3, 1903.

It's Not All Gold That Glisters.

To those of our readers who are making microscopical examinations of steel and to those who contemplate doing so the following incident may be of interest:

The metallurgical expert of one of the largest steel companies in this country, having extensive experience in this line, was submitted by a friend some microscopic photographs with the request that he select the one representing the best quality of steel, stating that after he had made his selection he would find the composition of the material marked on the reverse side of the photograph. After a careful comparison the expert decided they all represented good steel and finally selected one as being the best. Upon examining the reverse side of the photograph he was astonished to find that he had selected a microscopical photograph of a "ginger snap" as being the best grade of steel.

Newspaper items have been for months telling people that a locomotive building plant which will cost millions is about to be built at Port Dover, O., for the purpose of building the Dodge patent locomotives. We have been asked repeatedly, what are the Dodge patents? As far as we can learn the Dodge locomotive is designed to be operated by power derived from hot water. A great saving of fuel is of course promised, but how the saving is to be effected has not been shown. Capitalists are evidently supporting the scheme which, however, proves nothing, for capitalists will generally put up their money more readily upon a freak than upon a practicable invention, but the powerful support given to this peculiar locomotive will ensure that whatever merit it may possess will be thoroughly demonstrated.

What the tongue is, I suppose the man is.—*Tale of Two Cities.*

Liquid Fuel on the Pacific Coast.

Editorial Correspondence.

We have received so much uncertain information, and read so many conflicting statements in the last few years about the use of liquid fuel in locomotives on the Pacific coast, that I was keenly interested in seeing with my own eyes the methods of burning oil. Through the courtesy of Mr. George R. Henderson, superintendent of motive power of the Santa Fe, I was granted the privilege of riding on locomotives. I have ridden on liquid-fuel burning locomotives in England and in Russia, so I was in a good position to make a mental comparisons.

There is a popular belief that little skill is required to fire a locomotive successfully with oil fuel; but the experience of the Southern California and the Southern Pacific is, that it takes much more skill and judgment to fire an oil burner properly than it takes to fire with coal. To do the work properly the engineer and fireman must co-operate constantly, as the supply of fuel must be regulated according to the work the engine is doing. I rode a long way on one engine that was doing very irregular work with a heavy passenger train, sometimes running on the level and at other times ascending or descending grades, and the fireman did his work so well that a puff of smoke was rarely seen. Other engines that I watched appeared to smoke a little at every change in the intensity of work, while others again made smoke all the time. I was informed that when the tubes or fire box are leaking it is impossible to fire without considerable smoke.

The talk I heard both on the Southern California and on the Southern Pacific, was that oil fuel is harder on fire boxes than coal, and that the Vanderbilt furnace gets out of order more rapidly than other furnaces. This is a significant commentary on the prevailing methods of railroad management in this country. In itself, mineral oil is an ideal fuel, and contains no element which would injure the metal of the furnace, in the way that the sulphur and other impurities in coal does, but mineral oil provides the means of maintaining a tremendously high furnace temperature, and the tendency on our railroads is to keep the temperature up to its maximum intensity. That is done because the officials in charge are never satisfied to receive anything less than the very highest performance within the capacity of a locomotive.

There is reason to believe that the sheets of a furnace will sustain the strains due to a certain number of heat units going through them, and that they will be worn out when this volume of work has been done, no matter what time it takes. If, however, the fire is forced so that in one furnace the number of heat units is generated within a year that in another furnace would be spread over five years, it is not surprising that the hard pressed furnace is worn out in less than one-fifth the time that the other one will remain in working order. In addition to doing the work in a short time, the hard-worked furnace is subjected to destructive agencies that do not affect the other. An intensity of heat may be generated in a furnace that will keep the fire surface of the sheets almost red hot, and convert the water on the other side into steam so rapidly that the water is driven away from the sheets and never presents a dense body capable of absorbing the heat as it is generated. From that cause a hard-worked furnace will not give equal service to one moderately worked when the work is measured by heat units.

The state of the case on the Pacific coast, as I summed it up, is: A fire box of the ordinary pattern burning oil is capable of producing much more heat than it does when burning coal; a Vanderbilt furnace burning oil is capable of producing more heat than a fire box using the same fuel, and the result is that the furnace doing the most work requires the most repairs.

The mechanical officials of both the Southern California and of the Southern Pacific strive most persistently to overcome the difficulties experienced with the Vanderbilt furnace, but they do not succeed to their satisfaction, because the engines are chronically overworked. The Southern Pacific uses the Vanderbilt furnace engines on freight, and they do not give so much trouble as the Southern California engines of the same kind which are kept hauling passenger trains; but the difference accords with the difference of service. The engines on both roads receive about the same amount of care and of intelligent supervision. There is certainly no lack of care or of intelligent interest on either road. An official of the operating department was complaining to me about the trouble the Vanderbilt furnaces give, and I said that the engines were worked too hard, and advised that they be given lighter trains. That would never do, he replied. Locomotives are built to haul trains, and they ought to be worked at their utmost capacity.

Two ordinary oil-burning locomotives were engaged hauling certain passenger trains on a certain division of the Santa Fé, and they were by no means underworked; but it was found that an engine with the Vanderbilt furnace could do the work alone. The engine was badly overworked in hauling the trains, but there was no yielding, and the operative officials could not understand why an engine doing double work should need more repairs than one doing half the duty.

The locomotives burning liquid fuel on European railways are rated to do the same work as those of similar capacity burning coal or wood. There is no excessive heating of the evaporating surfaces, and the engines are light on repairs. But then, the mechanical department has charge of the engines and regulates the loading of them. If a similar practice prevailed in this country, oil burning would be considered an unmitigated success. It would probably pay better in the end to work locomotive furnaces much below their maximum capacity, but that would not suit the official who insists on every possible ton of load being hauled. A. S.

Notes from Australia—The Tyranny of Government Railway Officials.

During the last six months the railway men of the State of Victoria have had many troubles and trials. As the State owns the railways, the position of the men, in regard to wages, corresponds to the position of the finances of the State, whether good or bad. Just now Victoria is suffering from a depression, owing to a severe and prolonged drought. This drought has made the wheat harvest a complete failure and the railway department is being run at a loss. In order to make the railways pay, the Government has taken three per cent. of the men's wages, makes them work five days a week instead of six, and in addition all overtime is to be worked off instead of paid for, and all their small privileges such as free passes, privileged tickets have been abolished. Whilst all the starving stock was being shifted from the drought stricken parts of the State to the fertile lands of the south, the engineers and firemen were almost worked to death in consequence of the great rush of traffic. An engineer, returning to his home depot at Bendigo, fainted from exhaustion as soon as he stepped off his engine. He had been on duty for 36 hours continuously.

An amusing incident occurred at Geelong. The roundhouse foreman received orders to put his men on short time. That same day, all the engineers put in abnormally long hours, one being on duty for 30 hours. Last but not least of the troubles is the fact that the men have been deprived of their votes. At present the outlook is a little brighter, and we hope that in a very short time the men will receive their proper rights.

The Missouri Pacific Railway have decided to do away with the heavy locomotives at present in use on the Colorado division, and substitute therefor the smaller ones known as the 300 class, which are used on the prairie divisions. It is claimed that they are more economical to operate and better adapted to rapid transit.

Quick Welding of Frames.

In Railway and Locomotive Engineering of June, 1900, Mr. D. P. Kellogg, general foreman of the Southern Pacific shops at Oakland, Cal., had an illustrated description of the method he employs to weld locomotive frames without removing them from the engine. During a visit the writer made recently to the shops mentioned, Mr. Kellogg very kindly had the operation of welding a frame performed for our entertainment. It was one of the most interesting operations we have ever been privileged to witness. A broken pedestal had to be mended. They first jacked the parts asunder and inserted a piece of iron about ¾ inch in the break. The parts were then jammed together while the welding piece was red hot.

A small furnace was then built of fire brick and fire clay and an oil flame jet applied which gradually raised the frame to a welding heat. The parts were then hammered together by an Ingersoll-Sargent rock drill converted into a hammer. The time taken to finish the weld was about one hour.

Master mechanics or general foremen who are pushed to do engine repairs with the least possible delay, would do well to look into this system of welding locomotive frames. They will find enough particulars in the description written by Mr. Kellogg to enable them to introduce the system. Mr. W. H. Russell, master mechanic at West Oakland, remarked to the writer that he did not know what they would have done for engines during the rush times if this expeditious method of welding frames had not been introduced. The frames so welded stand the strains of service as well as those heated in a blacksmith forge.

To Make a Raid on Noises.

There is in the United States an academy of Ophthalmology, Otology and Laryngology, which has been holding a convention lately. From the published reports of the meeting, we infer that one purpose of the ologies is to oppose the production of noises. These ologians do not propose to assail preventative noises which torture the ears of every dweller of cities. They want to stop the noise of car wheels. We suspect that some one with a patent wheel is working up the ologies for his own behalf, for a petition was read urging boards of health throughout the United States to secure the attention of street car and steam railway companies for an early consideration of the sanitary, therapeutical value of noiseless car wheels. The petition requests the boards of health in the large cities to investigate the subject, with a view to bringing about a reform in the matter. A resolution adopted on the same subject says: "Thousands in our hospitals and homes, who are ill, need this courtesy, as they are rendered more ill by the din and clatter of the cars as they pass along the streets."

We believe that railroad companies would not wait for pressure from boards of health to adopt a noiseless car wheel if anything of the kind could be found, but it is impracticable. So long as steel tires run on steel rails there will be noise. Any number of patent noiseless wheels have been tried on the New York Elevated railroads, but they always made as much noise as the common kind that are not patented.

The Pressed Steel Car Company has removed its general offices from the Tradesmen's Building to the Farmers' Bank Building, Fifth avenue and Wood street, Pittsburg. This company has possession of the entire nineteenth floor and has spared neither money, time nor effort to make their offices the finest and best appointed in Pittsburg, and have new desks, furniture, carpets, typewriters and, in fact, everything requisite to making the offices bright and cheerful. All of the new furniture is finished in mahogany and presents a very rich and beautiful appearance. This company, therefore, entered their new quarters with nothing but their office records. A special invitation is extended to the friends of the Pressed Steel Car Company to visit these offices and pass judgment upon their superior qualities and elegance.

The American Steam Gauge & Valve Manufacturing Company and the Mowry & Phillips Company have become merged under the corporate name of the American Steam Gauge & Valve Manufacturing Company. The business heretofore conducted under the first-mentioned names will, hereafter, be conducted by the company in which the others are merged, being a corporation organized under the laws of the State of New Jersey. The officers of the new concern are as follows: John McCandlish, president; M. Briggs Phillips, vice-president; R. B. Phillips, secretary; and J. L. Weeks, treasurer and general manager.

The officials of the Brooklyn Rapid Transit Company tried to work a great scheme upon the Brooklyn Bridge Commissioners, but it did not work. They wanted to prepare the Elevated railroad cars to run on the surface street railways and to effect this they began putting in wheels with flanges $\frac{15}{16}$ inch deep instead of 1⅛-inch, the M. C. B. standard depth of flange. The Bridge Commissioners got on to the little scheme and compelled the Rapid Transit officials to restore the wheels of standard pattern.

Students' Antics.

The *Chicago Tribune* of April 12 contained the following item:

"Not satisfied with the results of their attempt at reforming election methods, University of Chicago students have turned their attention to industrial problems and the settlement of strikes. Several students shipped as stokers on the grain boats leaving for Buffalo yesterday morning.

"The strength of Prof. Stagg's athletes attracted the attention of the Lake Carriers' Association, and representatives of the company came to the trainers in Hitchcock Hall Thursday night and asked the young men to take the places of striking firemen. They offered $30 for the trip and transportation by rail back to Chicago.

"Seven students at once volunteered to go and were driven in carriages about midnight to the vessel. Their leader was Barrett C. Andrews, the freshman who was chief detective in the Western Passenger Association's case against the Wisconsin Central."

Though the young man may flatter himself with the titles of detective and strike-breaker, he has really earned the degree of "Spotter" and "Scab" and all the dishonor pertaining thereto.

Those who have read "The Letters of a Self-Made Merchant to His Son" will be reminded by this occurrence of old John Graham's opinion of college-bred men. He says: "College doesn't make fools; it only develops them. It doesn't make bright men; it only develops them. A fool will turn out a fool whether he goes to college or not, though he'll probably turn out a different sort of a fool. Some men are like pigs, the more you educate them, the more amusing little cusses they become, and the funnier capers they cut when they show off their tricks. Naturally, the place to send a boy of that breed is to the circus, not to college."

The Building Material Trades Council entered a protest with President Harper of the University, and there is a possibility of a strike of all union workingmen employed on the University buildings. The University authorities claim that they have no control over the students in such a matter, and know nothing of the affair except from the newspapers. The working-men, being in the position of the frog in the fable, are bound to protest.

Half a dozen scatter-brained students mistaking notoriety for fame, bravado for courage, cat's-paws for heroes bring to mind John Graham's educated pigs, at whose amusing capers the audience laughs, knowing well that their day will be short and the end thereof not pleasant —for the pigs.

The University of Chicago, which is educating these particular pigs, is not to be blamed because it has unfortunately been made the consignee of raw material which should have been billed to the circus.

Mr. H. B. Hunt, for several years mechanical engineer of the Erie at Meadville, has been appointed assistant to Mr. D. Willard, general manager. Mr. Hunt is a graduate of the Massachusetts Institute of Technology, Boston, and received all his practical training in the shops and drawing office of the Erie. He is succeeded as mechanical engineer by Mr. A. G. Trumbull, who has been chief draftsman. Mr. Trumbull is a graduate of Sibley College, Cornell University, and has also received his practical training on the Erie.

The Lake Shore & Michigan Southern have just ordered fifteen new passenger coaches that embrace decided ideas of progress. They will be seventy-two feet long and will seat eighty-four people, that is more than any coach now in use, except those received by the Lake Shore recently. They will be finished in mahogany and the whole interior as well as the exterior will resemble very closely the Pullman car. They will probably cost about $12,000 apiece. They will be used on regular through trains.

The Southern California Railway people in the shops at San Bernardino, Cal., are making material reduction in the reciprocating parts of their heavy engines by making the piston heads of cast steel. The head is solid and cast-iron rings sprung on. The lightening operation has enabled them to dispense with the use of front extension piston rods which had been found a source of annoyance without any visible benefit.

Mr. George H. Daniels informs us that on the Putnam Division of the New York Central for the month of March, 99 and 73-100 per cent. of the trains were on schedule time. Out of 3,400 passenger trains handled, only 11 were late. It is thought that this record has never been surpassed and seldom if ever equaled.

The air compressors in the railroad shops at Oakland, Cal., compress air for all the yards and station signals besides providing the supply for pneumatic hammers and other shop tools. It takes 1,000 cubic feet of free air per minute to keep up the supply. Pneumatic tools are greatly in evidence in these shops.

Ride on. Rough-shod if need be, smooth-shod if that will do, but ride on. Ride over all obstacles and win the race.—*David Copperfield.*

Fine Catalogues.

The Niles, Bement, Pond Company, 136 Liberty street, New York, have issued two very handsome trade catalogues. One is concerned with multiple drilling machines, and the other with horizontal boring, drilling and milling machines. In the first of these, machines of two general types are shown, viz., multiple drills in which the spindles are adjustable to any position in a given line; and adjustable multi-spindle drills, in which the spindles may be arranged in a group of any size within the capacity of the machine. The catalogue also contains descriptions of a full line of multiple drilling machines suitable for railroad work.

In the latter catalogue such machines as horizontal drilling, tapping and boring machine; double drilling, tapping and stud inserting machines; horizontal boring, drilling and milling machines of all kinds are shown in excellent half-tones, accompanied with suitable letter press. The concluding pages show types of these various machines at work. The company will gladly send either or both of these catalogues to those who write to them for copies.

The New York Air Brake Company are about to enlarge their plant at Watertown, N. Y. They also expect to arrange for their workmen building houses for themselves. A dispatch from Watertown says: A tract of 268 acres, lying within the city limits toward the east, has been purchased and along the main street the factories will extend for nearly half a mile. In the rear of the factories a tract of 400 by 1,300 feet has been laid out for an athletic ground for the workmen, while the main body of the tract lying to the north, has been laid out in streets with 564 building lots, which will be disposed of to the workmen desiring to locate near the works. On the rear of the purchase is about sixty acres covered by handsome trees and lying nearly level. This has been laid out with drives and walks and will be cleaned and beautified and thrown open to the city under the name of Starbuck Park.

The Philadelphia Pneumatic Tool Company, of Philadelphia, have just issued a neat little poster showing a workman engaged in riveting up a sign bearing the words "Keller Pneumatic Tools" which the company say are modern tools for modern plants. There is no doubt that the poster shows a man working on the sign, but another object he has in view not so immediately apparent is to rivet the attention of the beholder. The workman does both these things very well. Information concerning the Keller tools may be easily obtained by applying to the company.

The A. Leschen & Sons Rope Company, manufacturers of wire rope and aerial rope tramways, with headquarters at 920 to 932 North First street, St. Louis, Mo., have just opened an office and warehouse at 1717-1723 Arapahoe street, Denver, Col., where they will carry a full stock of their various grades of wire rope, manila rope, etc. This gives that concern four branch offices and warehouses in addition to their headquarters at St. Louis. The offices are at 92 Centre street, New York city, N. Y.; 137 East Lake street, Chicago, Ill.; 85 Fremont street, San Francisco, Cal., and the Denver office just opened. This company not only manufactures all ordinary grades of wire rope, but they are also sole manufacturers of the celebrated Hercules Colored Strand Wire Rope and of Patent Flattened Strand Wire Rope. They also make tramways which load and unload automatically, and they make several types of friction grip tramways and also single line and two bucket tramways.

The Atlanta and West Point has recently purchased some ten-wheel freight locomotives from the Rogers Locomotive Works, the first have already been put to work and are giving excellent service, little trouble being experienced from hot journals and driving rod boxes. With the exception of the Central of Georgia's consolidation engines on the Columbus and Birmingham division they are the heaviest in service in the Southern States.

The Locomotive and Machine Company, of Montreal, Limited, has given the Westinghouse Electric and Manufacturing Company, Limited, a contract for eighty motors, bearing from five to fifty horse power each. A contract for heavy machinery, at an expenditure of $130,000, has been awarded the Niles, Bement, Pond Company.

Griffith & Winters, a firm in Chicago which sells books has reproduced our educational chart No. 2, (the American Locomotive) and are giving it as a premium with their books. As the chart cost us a great deal of money to make and is protected by a copyright we intend protecting our rights in the courts if necessary.

The repair shops belonging to the Santa Fé at Topeka are so well provided with facilities for doing new work that the officers of the company have decided to work the shops to their full capacity in building new locomotives.

The Nashville, Chattanooga & St. Louis have recently built 500 box cars in their shops at Nashville, Tenn., and they now have commenced working on an order for 250 gondola cars.

At the last meeting of the Board of Directors of the Allis-Chalmers Company held in New York, April 15, the regular quarterly dividend of 1¾ per cent. was declared on preferred stock. The volume of business on the books of the company to-day far exceeds that of any time since the organization of the company, notwithstanding the fact that the output of the plants has been increased to a large extent. The company say: We can see no abatement of prosperity in our various branches of manufacture. There seems to be an unlimited demand for all kinds of high grade machinery, which is certainly a good indication that prosperity is enjoyed in all lines of manufacture.

Smooth-On in the Shop.

Many breakdowns to machinery subjected to steam and hydraulic pressure, it is said, can be successfully repaired by use of the material known to engineers as Smooth-On Iron Cement. The following is an extract from a report made by an engineer in the Department of Construction and Repairs in the New York Navy Yard:

"For over four years I have used Smooth-On Iron Cement No. 1, and have found it to be as good as a new casting when used in repairing breaks in castings. I have found it to make steam joints tight when everything else failed. I have used it on porous castings that had to stand 180 pounds steam pressure. I have used it on steam pipes that leaked, and will say that I have never had any trouble with anything I repaired with it. About four years ago one of our 45-inch centrifugal pumps split almost in two, due to a sudden strain. The crack was over twenty feet long and in some places opened up three-quarters of an inch. This fracture was repaired with Smooth-On Iron Cement No. 1, and the pump was running on the third day; it ran successfully for thirteen months, when it was replaced by a new pump."

Smooth-On Iron Cement No. 1 is a metal cement which, when properly mixed with water, "metalizes" and slightly expands during the process. This iron cement is made by the Smooth-On Mfg. Co., Jersey City, N. J., U. S. A., who will send their illustrated book free to anyone who is interested enough to write them for it.

Luis Jackson, industrial commissioner of the Chicago, Milwaukee and St. Paul Railroad, recently completed a tour of the Eastern States, and he appears to have been disgruntled because he was obliged to pay his fare on the Eastern lines. He says: "For the first time I paid fare to Boston. I can understand the excluding of everybody outside of the railroad business from free transportation, but when it comes to excluding one's own kind it looks to me like a case of 'dog eat dog.' No exchange passes are issued east of Buffalo, but from there west all railroads exchange. I consider that the person who originated this state of things did not belong to the enterprising class that has made the world's railroad service what it is. Taken at his par value he would be dear at $100 per month."

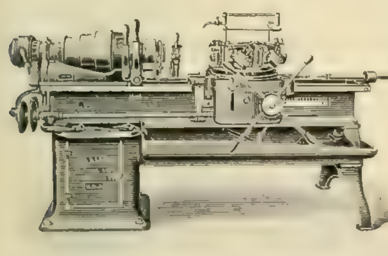
A Modern Booking Office.

In the old stage-coach days in England the engaging of seats in the coach, whether inside the vehicle or out, was done by passengers at the stage coach office, and the name of the person and his position in the coach were recorded in a book, hence one might say in olden times he had "booked" a passage up to London. As the modern railway was evolved, this old vehicle was mounted on a frame supported on wheels capable of running on rails, and several coaches were coupled together in a train. We use the word "coach" at the present time to describe a passenger car, and the origin of the word is quite clear. In England they still use the designation "Booking Office" in railway stations, to indicate the place where tickets are sold, though the old-fashioned book in which passages were recorded has long since passed away. There is, however, another sense in which we are constrained to use the expression "booking office." We cannot sell you railway tickets, it is true, but the office of RAILWAY AND LOCOMOTIVE ENGINEERING is a booking office in the sense that it will supply you with any book you require. Cast your eye down the list of what we especially recommend. Do you wish to book a passage up to the good old town of Knowledge? A year's subscription to RAILWAY AND LOCOMOTIVE ENGINEERING costs only $2.00. It is well worth the money, and, besides, the paper is a welcome visitor in every household, especially where there are children.

"The World's Railway" is a most interesting history of railways and locomotives. It is beautifully illustrated and the net price used to be $10.00. We now give it and a year's subscription to RAILWAY AND LOCOMOTIVE ENGINEERING for $5.00.

"Locomotive Engine Running and Management," by Angus Sinclair, is an old and universal favorite. A well-known general manager remarked in a meeting of railroad men lately, "I attribute much of my success in life to the inspiration of that book. It was my pocket companion for years." We sell it for $2.00.

"Practical Shop Talks." Colvin. This is a very helpful book, combining instruction with amusement. It is a particularly useful book to the young mechanic.



It has a stimulating effect in inducing him to study his business. Price, 50 cents.

"Examination Questions for Promotion," Thompson. This book is used by many master mechanics and traveling engineers in the examination of firemen for promotion and of engineers likely to be hired. It contains in small compass a large amount of information about the locomotive. Convenient pocket size. We cordially recommend this book. Price, 75 cents.

"Compound Locomotives." Colvin. This book will instruct a man so that he will understand the construction and operation of a compound locomotive as well as he now understands a simple engine. Tells all about running, about breakdowns and repairs. Convenient pocket size, bound in leather, $1.00.

"Catechism of the Steam Plant." Hemenway. Contains information that will enable a man to take out a license to run a stationary engine. Tells about boilers, heating surface, horsepower, condensers, feed water heaters, air pumps, engines, strength of boilers, testing boiler performances, etc., etc. This is only a partial list of its contents. It is in the question and answer style. 128 pages. Pocket size. Price, 50 cents.

"Care and Management of Locomotive Boilers." Raps. This is a book that ought to be in the hands of every person who is in any way interested in keeping boilers in safe working order. Written by a forman boilermaker. Also contains several chapters on oil-burning locomotives. 50 cents.

"Locomotive Link Motion." Halsey. Any person who gives a little study to this book ceases to find link motion a puzzle. Explains about valves and valve motion in plain language, easily understood. $1.00.

"Machine Shop Arithmetic." Colvin and Cheney. This is a book that no person engaged in mechanical occupations can afford to do without. Enables any workman to figure out all the shop and machine problems which are so puzzling for want of a little knowledge. 25 cents.

"Firing Locomotives." Sinclair. Treats in an easy way the principles of combustion. While treating on the chemistry of heat and combustion is easily understood by every intelligent fireman. 50 cents.

"Air-Brake Catechism." Conger. Nothing better can be found for persons trying to learn all about air brakes. Tells the whole story. Cloth, 75 cents. Leather, $1.00.

"Skeevers' Object Lessons." Hill. A collection of the famous object lesson stories which appeared in this paper several years ago. They are interesting, laughable and best of all they are of practical value to-day. $1.00.

"Stories of the Railroad." Hill. Best railroad stories ever written. Those who have not read these stories have missed a great literary treat. $1.50.

"Block and Interlocking Signals." Elliott. Tells what signals are, what they do and how they do it. Comprehensive treatise on the subject. Ought to be studied by all trainmen where block signals are used. $3.00.

RAILWAY AND LOCOMOTIVE ENGINEERING. Bound volumes. $3.00.

We understand that Mr. George E. Martin, who has been for some time past superintendent of the Pedrick & Ayer Company's shops, has tendered his resignation, which has been accepted.

The Shelby Steel Tube Company, of Pittsburgh, Pa., have sent their friends a very neat little souvenir in the shape of a paper knife. Interest in the useful little article centers in the fact that it is made out of a Shelby steel tube. A piece of ⅜-tube about 9 ins. long is flanged over at one end just as a locomotive tube is beaded, and the tube, for a distance of about 3½ ins., is left as manufactured. The whole tube, however, is formed so as to have a slight reverse curve. The blade of the knife is made by simply compressing or flattening part of the tube and cutting away a portion of the end so as to give the knife a sharp point, which is useful in opening letters. The name of the company is stamped on the blade. Those who have letters to open and desire to have a neat and handy instrument to do it with, had better send the Shelby company a sealed envelope for them to open, containing a polite request for the souvenir.

"Seen From the Car," or travel as a fine art, is No. 31 of the "Four-track Series" issued by the passenger department of the New York Central Railroad. It was written by Mr. Charles Barnard and touches interestingly on the geology, the geography and the history of that delightful region which stretches from the palisades of the Hudson to the cataract of Niagara. Of course, there are many more things in this pleasing little hand book than can be seen from the car, and Mr. Geo. H. Daniels, whose office is in the Grand Central Station, New York, will be happy to send a copy to any one who applies for it and who sends five cents in stamps.

Portfolio of Views.

Thirty-three magnificent reproductions of photographic views of various scenes along the Fitchburg Division of the Boston and Maine Railroad is what this new portfolio consists of. The delightful panoramic scenery of the Hoosac country and Deerfield Valley, the dashing waterfalls and towering mountains are all

aptly portrayed in this new addition to the Boston and Maine's Art Library. This book is entitled "The Charles River to the Hudson," and will be mailed to any address upon receipt of 6 cents in stamps by the General Passenger Department, Boston and Maine Railroad, Boston. The complete set, consisting of the other five portfolios, and this new one, will be mailed upon receipt of 36 cents.

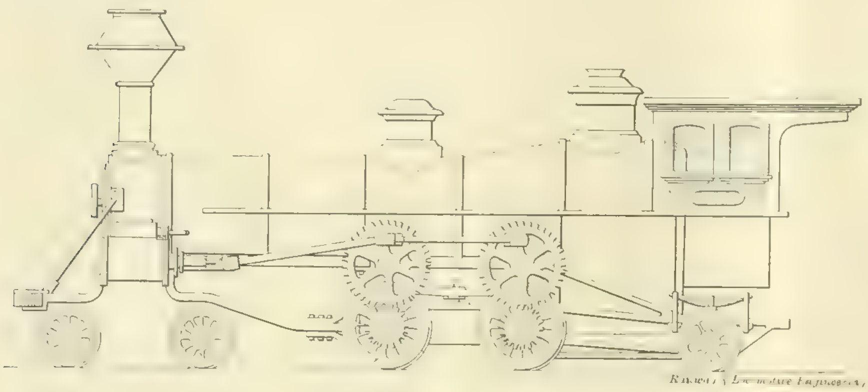
The Latest Locomotive Freak.

We received from Mr. Charles Hopgood, St. Louis, the blue print from which the annexed cut was made. Mr. Hopgood says:

"I enclose a drawing and description of an improved driving mechanism for a locomotive engine which I have invented and for which a patent has been allowed.

"I shall be obliged if you will kindly publish the same in your valuable journal, as I am desirous of obtaining the views of engineers thereon.

"I think that with this mechanism more power and speed, with smoother running, can be obtained than with the ordinary method of driving."



THE LATEST FREAK.

Among the orders being filled by the Hicks Locomotive and Car Works, of Chicago, it may be mentioned that the Bessemer & Lake Erie has ordered a chair car, also a 60 ft. baggage car; the Rodgers-Allison Lumber Co., Vanderbilt, Mich., have ordered a locomotive. The Hicks works have received miscellaneous freight car orders from the Gold Bar Lumber Co.; the Missouri, Arkansas & Western Ry.; the Union Traction Co., of Indiana; the Coal Belt Ry. Co.; Fairbanks, Morse & Co., Central Arizona Ry., Detroit & Mackinac Ry. and the Santa Fé Central Railway have ordered two eight-wheel cabooses.

The annual report for 1902 of the Pressed Steel Car Company, of Pittsburgh, has just been issued in very attractive form. In speaking of fire losses, the report says, concerning a fire which occurred in the Allegheny shops on Chrismas day, that a fire corps has been organized in the Allegheny and McKee's Rocks works, and it is largely due to their effective work that the fire loss has been kept down to a low point. During the year two gas wells were drilled on the property owned by the company and a good supply of natural gas was the result. The number of cars built in 1902 was 27,456, and 4,148 steel underframes for wooden cars. This is an increase of 11.7 per cent. over the number of cars turned out in 1901, while the output of truck frames was practically doubled. The company has orders booked and business in sight which will keep all plants busy for some time to come.

A folder issued by the Chicago Pneumatic Tool Company of Chicago has just come to hand. All sorts of pneumatic hammers, long stroke, chipping caulking, and beading, are shown together with piston air drills, Boyer drills, compressors, painting machines and a very ingenious pneumatic motor hoist, in which a little motor turns a small drum and so winds up a light steel cable. The whole thing hangs from a hook in the shop ceiling. The motor is operated by air but the drum is of course windless—we mean a windlass. Write the company if you are interested.

The Stannard & White Company, of Racine Junction, Wis., who are the makers of a large variety of locomotive cab seats, the Atlas railway car mover (which is really a very powerful pinch bar), gauge glass cutters and other comfortable and useful articles, have recently issued a book on camping, containing 120 pages and 200 illustrations. It is a manual of camping, and contains 16 pages of camp-cooking receipts, and it tells what to do in case of accidents when campers are out of reach of medical aid. The Stannard & White Company will send this book—it is not a catalogue—to their friends on receipt of ten cents in stamps or coin.

A Universal Ratchet.

The Armstrong universal ratchet was formerly known as the Williams universal ratchet drill, and was invented by Mr. Harvey D. Williams, who was at one time connected with Cornell University. The successful application of the laws of theoretical mechanics to the making of a highly efficient and thoroughly practical tool is not the only interesting feature about this device. The ratchet is capable of use in very restricted places, and this is one of its most valuable characteristics. The universal motion is secured by placing the axis of the two trunnions upon which the handle turns at an acute angle to the axis of the ratchet. About two inches of motion of the end of the handle in any direction whatever, will drive the tool; in fact, even a vertical motion of the handle will suffice to do work. The tool can be operated quite satisfactorily with the handle between the spokes of a wheel. In the section here illustrated there are twelve teeth and four pawls; thus, 48 catches are made in each revolution. This size, No. 4, drills holes up to 1 in. diameter. The only other size made is No. 6, which drills holes up to 2 in. diameter. In this latter there are five pawls, which engage with the 12 teeth. The pawls, therefore, catch 60 times in one revolution, and on this account the tool is said to cut about one-seventh faster than the common ratchet. The handle can be rigidly fixed by screwing up a set screw in one of the three countersinks in the ball of the tool. This makes the handle practically equivalent to that of the ordinary ratchet, and the possibility of making it thus rigid is provided for convenience of operation in certain cases.

THE ARMSTRONG UNIVERSAL RATCHET.

SECTION OF UNIVERSAL RATCHET.

The Armstrong Brothers Tool Company, or, as they are often called, "the tool holder people," of 617 Austin avenue, Chicago, will be happy to send catalogue or other information to those who are interested enough to apply to them.

A Poser.

An amusing story is told of how a lady tourist "stumped" a railroad superintendent in Alaska. The town of Skagway was fortunate enough to be served by a railway in the early days when the milk used in that far away town was condensed milk brought there as canned goods. The locomotive which brought this lady to Skagway was furnished with a pilot of the usual form and secured in the correct position. The lady, meeting the superintendent on the platform expressed a desire for some information which the railroad man gallantly offered to give. She therefore propounded this question: "Why do your locomotives wear cow catchers when the only cows you have in this country are in sealed cans?" The official was speechless.

Not Responsible for Fires from Sparks.

A dispatch to St. Louis headed something new in court rulings reads:

A Kansas court has decided that if a railroad company has good modern appliances and careful and competend engineers and firemen damages cannot be collected when a locomotive spark burns a planing mill, a lumber yard, a Methodist church and several minor buildings. This is quite important to both railroads and owners of buildings.

That ruling is by no means novel. It is a long time since the courts first decided that when a railroad company applied the most approved spark arresters on its locomotives a suit would not hold against it for causing fires by sparks.

The man who knows only one subject is next tiresome to the man who knows no subject.—*Christmas Stories.*

Tandem Compounds Gaining Favor.

The American Locomotive works at Schenectady has been building some large tandem compound engines lately of the 280 type. Fifteen of these are for the New York Central and are the heaviest engines of this class which that road has ever purchased, having a total weight of 225,000 pounds, 200,000 of this being on the drivers. The cylinder dimensions are 16 and 38 by 34 inch stroke. They have small driving wheels, which give them a tremendous tractive power, enabling them to haul 100 light freight cars. This does not represent the entire capacity of these engines, which could haul a larger number of cars were there no grades, and if the draw rigging of the cars could stand the pull. The company is also fulfilling a contract of twelve engines for the Kinshiu railroad of Japan. These are of the 260 type and are designed for narrow gauge service.

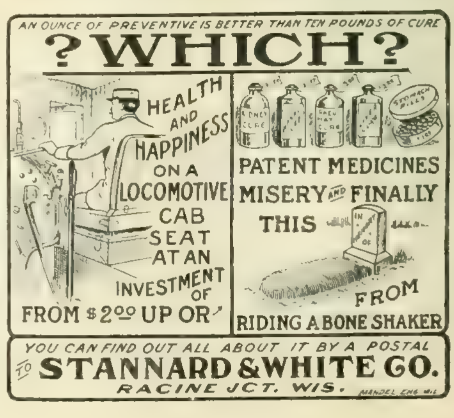
Block Signal Expansion.

The automatic block signal system on the New York Central Railroad will be extended over 434 miles, while 39 pneumatic and 54 mechanical interlocking plants, in addition to those now in use, are to be installed. Grade crossings to the number of 44 are to be eliminated.

No less than 469 new steel bridges, with an aggregate length of 125,000 feet, single track, are included in the improvement plans. These bridges, containing about 133,000 tons of steel, will cost over $5,000,000, apart from the new foundations which will be built in many cases. —*Philadelphia North American.*

A very neat little illustrated catalogue concerning Westinghouse Fan Motors has just been got out by the Westinghouse Electric & Manufacturing Company, of Pittsburgh, Pa. The fans are suitable for desk or wall bracket, as required, and are made some to be operated by direct and some by alternating current. The electric fan is getting more and more to be one of the indispensable adjuncts to the modern café and smoking car. The company will be happy to send the catalogue to those interested enough to apply to them for it.

The Electric Contract Company of New York announce that they have moved their quarters to 202 and 204 Centre street, in this city, where, with largely increased facilities, they will be able to handle their growing business to greater advantage. This firm makes portable electric lamps, and electric torches. The company will be happy to forward copy of their catalogue to any one who will write to them for it.



Nearly all railroads are increasing their orders for locomotives and steel rails and it is hard to find a triffic official who does not anticipate a heavy traffic the present year. The larger lines now have the tracks about as full of trains as is possible; especially is this true of the Pennsylvania Railroad. The tracks will not always stand the heavy strain now brought to bear upon them and sooner or later they will have to be thoroughly overhauled. It is stated that more rails will be laid on extensions and connections during the year than in many years past. It is estimated that the unfilled business on the books of the steel rail plants of the country is nearly 3,000,000 tons.

Those most familiar with the vast amount of energy that has to be transmitted for the moving of heavy fast trains have very little to say about electricity monopolizing the business of moving all trains in the near future, but fools rush in where angels fear to tread. Some one connected with the Pennsylvania recently said to a New York reporter: "In connection with the entry of our road into your city, of course, all trains in the tunnel will be propelled by electricity. This means that all trains passing from New Jersey to Long Island will be electric; which means that in a short time all through trains to Boston and New England in general will be electric; which means—well, to be plain and frank, the building of the tunnel and its electric equipment means that in a short time there will not be a locomotive on the Pennsylvania Railroad between New York and Philadelphia."

The Youngstown car manufacturing company directory are considering the installation of additional machinery to the plant for the construction of steel cars. It is said the project has advanced so far that specifications have been drawn for new buildings and tenders asked from machinery builders for the equipment of the plant.

The Southern California people, in their shops at San Bernardino, use a sort of Bessemer furnace for melting brass. They blow the inflammable mixture of oil gas and air through the mass to be melted. They say that the process is decidedly cheaper than melting in crucible.

We have been informed that the gross earnings of the Chicago Great Western Railway (Maple Leaf Route) for the second week of March, 1903, show an increase of $10,152.50 over the corresponding week of last year.

The work on the building of new car shops at Savannah, Ga., was commenced on April 14. The work will be rushed to completion as rapidly as possible.

Watering Can Necessary at Times.

On board one of the northern pleasure steamers, which have to be built with exceedingly light draught to get over the frequent shallows of the river, a Yankee tourist remarked to the captain, a shrewd old Scotchman:

"I reckon, skipper, that you think nothing of steaming across a meadow when there's been a heavy fall of dew?"

"That's so," replied the captain, "though occasionally we hae to send a man ahead wi' a watering can."—*London Tit Bits.*

CONTENTS.

INDEX TO ADVERTISEMENTS.

ATLANTIC CITY A PLEASANT FALL RESORT.

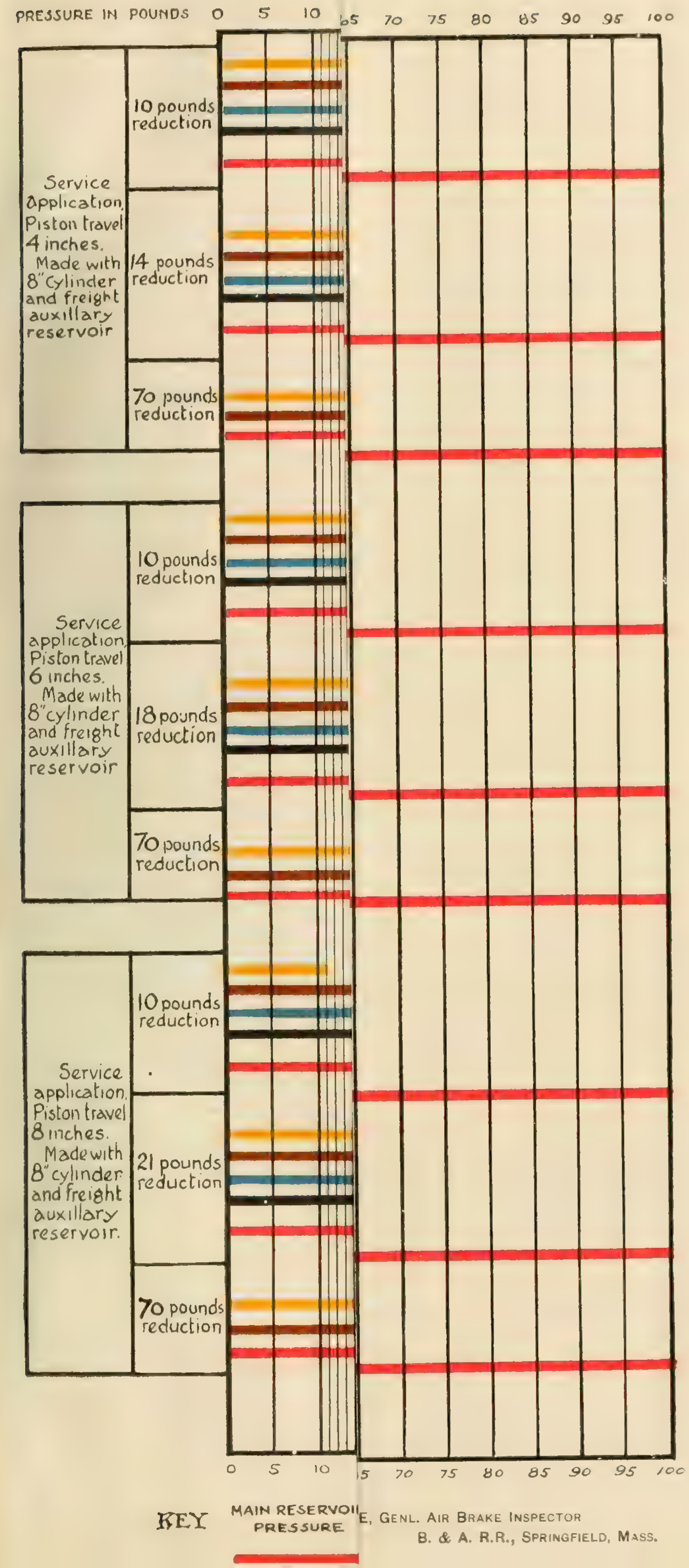
SOCIAL LIFE STILL A FEATURE.

In many ways Atlantic City is the most novel place in the world. Even though it is a shore resort its season is twelve months long and at all seasons there is something doing. The great hotels, and there are many of them, are open all the year and the service is fine at all times.

Atlantic City is a city in every sense of the word, and every convenience is afforded, including golf, driving, theatres and similar diversions.

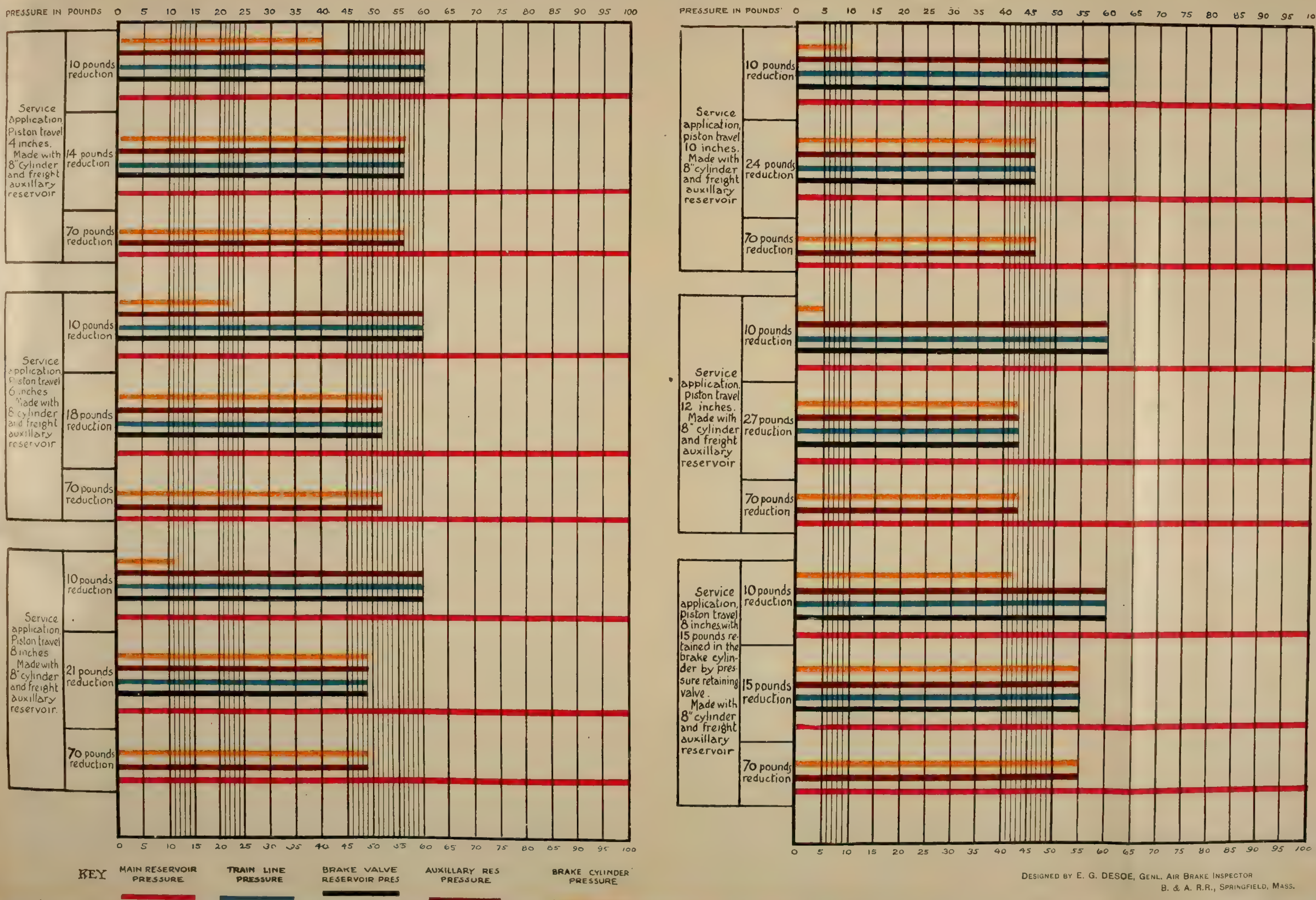
It is a particularly healthful place and the autumn months at Atlantic City are always charming. The famous promenade, the boardwalk, is ever interesting, and no better season can be selected for visiting this famous watering place. The New Jersey Central operates 3 hour trains to Atlantic City from New York at 9.40 A. M. and 3.40 P. M. These trains are models in every respect, and the arrival at Atlantic City is in time for luncheon and dinner. The route is by far the shortest from New York, and the General Passenger Agent of the New Jersey Central, New York has prepared an illustrated booklet on Atlantic City which, upon application, will be sent to any address.

INDEX TO ADVERTISEMENTS.



E, GENL. AIR BRAKE INSPECTOR
B. & A. R.R., SPRINGFIELD, MASS.

Color Air Brake Chart, Issued by Railway and Locomotive Engineering.



Designed by E. G. Desoe, Genl. Air Brake Inspector
B. & A. R.R., Springfield, Mass.

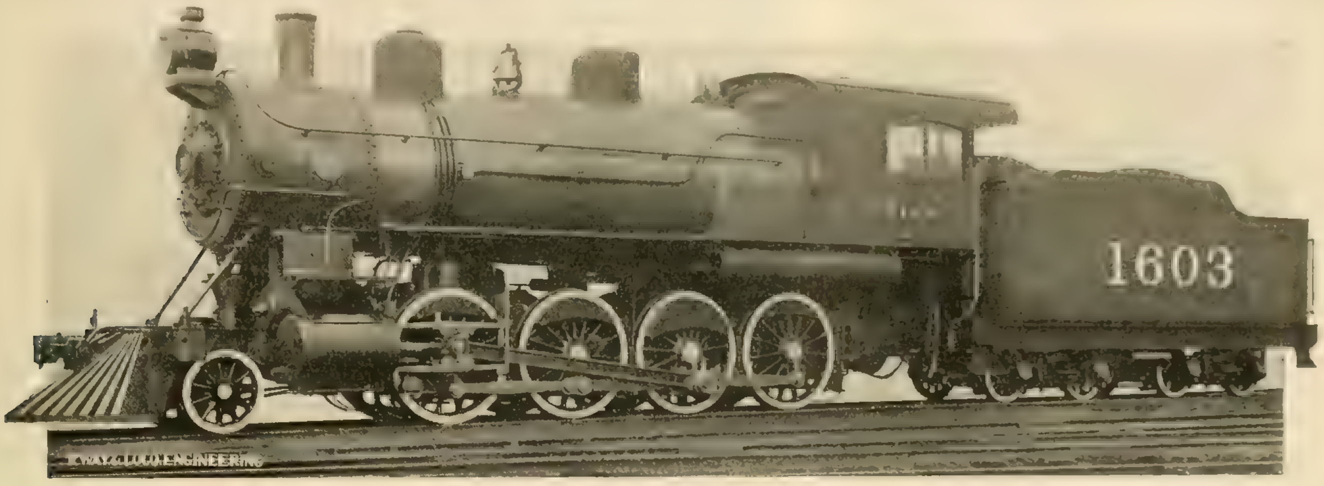
Railway and Locomotive Engineering

A Practical Journal of Railway Motive Power and Rolling Stock

Vol. XVI. 174 Broadway, New York, June, 1903 No. 6

Consolidation Engine for the Rock Island.

The American Locomotive Company have lately supplied the Chicago, Rock Island & Pacific with some powerful 2-8-0 engines, built at their Dunkirk shops. The engines are probably the heaviest now on the C., R. I. & P., the machine weighing in all 202,500 lbs. The engine is simple and has cylinders 22x30 in. The driving wheels are 63 in. in diameter and carry a weight of 182,000 lbs. With 85 per cent. of the boiler pressure, which is 200 lbs., assumed to be the mean effective pressure at slow speed, the maximum tractive effort is



ROCK ISLAND CONSOLIDATION ENGINE.

39,200 lbs., and the ratio of tractive effort to adhesive weight is therefore 4.6.

The engine has a large boiler which is 72⅛ in. at the smoke-box end and a total of 3,264 sq. ft. of heating surface has been provided. This, with the ample fire-box, guarantees good steaming qualities. The boiler is of the extended wagon-top type, with plenty of steam room.

The valve gear is direct, and operates a piston valve having inside admission. This arrangement reduces the wear and tear on valve-stem packing at both ends, as it is only required to stand the comparatively light and intermittent pressure of the exhaust steam. That prolific steam waster, the clearance, has been very materially reduced in this design. The valve chamber is placed in the direct line of steam passage, and as close to the cylinder as possible, so that the steam spaces to be filled and emptied at each stroke are as small as can be made. The valve-rod transmission bar is slightly curved, in order to work freely over the leading axle, and being a steel casting, is stiffened latterly with webs.

There are many familiar Brooks details about this engine, among others, the band-like spring hanger and the reach rod of 2 in. extra heavy wrought iron pipe. The pilot stays are riveted to the smoke box and pinned to the front foot plate. The headlight frame is below the level of the top of the smoke box. The diameter of the engine-truck wheels is 36 in., running in a radial swing truck.

Some of the leading dimensions are as follows:

GENERAL DIMENSIONS.

Weight in working order, 202,500 lbs.
Weight on drivers, 182,000 lbs , weight engine and tender in working order, 347,500 lbs.
Wheel base, driving, 17 ft.; total, 26 ft.
Wheel base, total, engine and tender, 57 ft. 6 in.

CYLINDERS.

Cylinders, 22x30 in.; size of steam ports, 2x29 in.; exhaust ports, 65 sq. in.; bridges, 3⅜ in.

VALVES.

Kind, improved piston; greatest travel, 5 11/16 in.; outside lap, 1 in.; lead in full gear, 3/32 in.

WHEELS, ETC.

Dia. of driv. wheels outside of tire, 63 in.

BOILER.

Style, radial stayed extended wagon top.
Outside dia. first ring 72⅛ in ; work. press. 200 lbs.
Fire box, length, 108 in.; width, 68 in.; depth, front, 75½ in.; back, 61½ in.; plates, thickness, sides, ⅜ in.; back, ⅜ in.; crown, ⅜ in.; tube sheet, ⅝ in.; wat. space, 4 in. fnt., 4 in. sides, 4 in. bck.
Tubes, number [illegible], dia., 2 in., length over tube sheet, [illegible] ft. [illegible] in.
Heating surface, tubes, [illegible] sq. ft., fire box, [illegible] sq. ft.; total, 3,264 sq. ft ; grate surface, 50 sq. ft.
Smoke stack, top above rail, 15 ft. 7½ in.

TENDER.

Weight, empty, [illegible] lbs ; wheel base, [illegible] ft.
Ten. frame, 13 in. channel; ten. trucks, Brooks pat.
Water capacity, 7,000 U. S. gals.; coal, 15 tons.

Trans-Continental Railways of the World.

Nearly every country with any sort of enterprise, and with any considerable extent of territory, has one or more trans-continental railway projects under way or completed. The United States was the pioneer in this respect and still remains first in the field. Canada comes next, and even now has a second trans-continental railway scheme on hand. The trans-Siberian Railway, about which we give some information in another column, is Russia's most important railway undertaking, and although this was built originally as a military line, it cannot help being of the greatest commercial importance as time goes on. The Cape to Cairo road, though not strictly a trans-continental line, as it runs north and south in Africa, is nevertheless technically such a road, and is being pushed forward by our British cousins as rapidly as possible. There is also the Chili-Argentine railway project, which will one day be an important South American line. Not long ago there was some talk

of Great Britain joining France and Germany in the construction of what press dispatches call the Bagdad Railway. The idea seems to be to run a line probably from the town opposite Constantinople on the Bosphorus, to some terminus on the Persian Gulf. This will practically be a trans-continental line. Part of this line is already in existence, so that Kouia will be the point from which construction will now begin.

There is also the Australia trans-continental railway, which, like the British road in the "Dark Continent," will run north and south. The State of South Australia, as its name does *not* imply, occupies the central portion of the continent, and is a belt of territory, roughly speaking, in the neighborhood of 800 miles wide, extending from the north coast to the south. It so happens this one State is thus able to span the island by a railway without calling upon the Commonwealth to assist in the work. At present the two ends of this line are in existence. A road from Port Darwin on the north, extends in a southerly direction for about 145 miles, and from Adelaide, on St. Vincent Gulf, a line runs about 688 miles northward. The gap between these, which has yet to be built, is about 1,063 miles. When completed, the Australian "perpendicular" trans-continental railway will be about 1,890 miles long. Tenders for the work are being asked for in Great Britain, France, Germany and the United States, and when completed the road will be State-owned, as are the other railways of Australia.

Milwaukee Road to Build Locomotives.

The Chicago, Milwaukee & St. Paul has determined to build its own locomotives in the future. The high prices demanded for locomotives, coupled with the inability of American locomotive builders to make deliveries promptly, induced the company to take this step, and new shops for locomotive building are now being constructed at Milwaukee, with a capacity of from 80 to 90 locomotives annually.

J. A. Barr, lately general superintendent, has become assistant to President Earling, and will have general charge of this feature of the company's policy. He is one of the best mechanical engineers in the country, and was formerly with the Baltimore & Ohio and Erie. The change of position for Mr. Barr will necessitate other changes, which are noted in our personal department.

We have on our list at present several good men looking for positions as general foreman or master mechanic. We do not recommend any but efficient men, so superintendents of motive power looking for help will find it an advantage to correspond with us.

Growth of the Locomotive.

BY ANGUS SINCLAIR.

(*Continued from page 164.*)

In my last article I forgot to mention that the interesting illustration of the track which Trevithick used came to me through the courtesy of Mr. Clement E. Stretton, C.E., of Leicester, England, a well-known engineer and author.

PROSPERITY PROMOTED RAILROAD ENTERPRISES.

The beneficent administration of John Quincy Adams, which ended in 1829, left the country so prosperous that there was unusual surplus capital to invest in industrial enterprises. The operation of railroads promised to be so profitable that capital was readily secured for the building of new lines. In some States excitement in favor of railroad building became vigorously active about 1830, and continued till the inevitable panic of a few years later converted the golden day dreams of many investors in railroad securities into hideous nightmares of ruin.

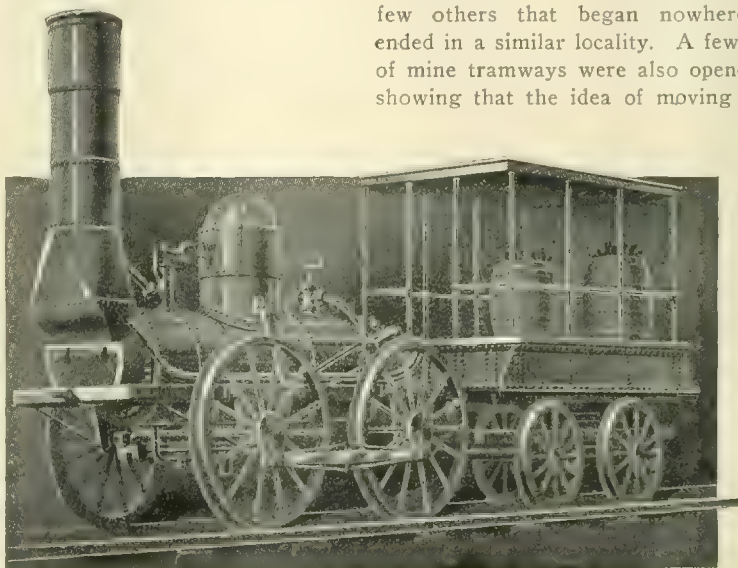
PIONEER FRAGMENTS.

During 1830 many charters were granted for the construction of railroads, and considerable work was done on short sections that now belong to great railroad systems and are boasted about just as families boast about the antiquity of their ancestors, who often in the flesh were very inferior creatures.

In 1831 seven miles of the Baltimore & Susquehanna Railroad were finished, and an English engine, the "Herald," was imported to operate it. This engine has a historical association, since Ross Winans applied four small leading wheels to it, about the time that John B. Jervis applied the four-wheel truck in front of an engine belonging to the Mohawk & Hudson. The purpose of both inventions was the same, but the means employed was different, yet a fierce controversy arose about who was the originator of the leading truck, which afterwards became so popular.

The Baltimore & Susquehanna was subsequently absorbed by the Northern Central Railroad, which in its turn was swallowed by the Pennsylvania Railroad Company. It is usual to say that the Camden & Amboy was the first link built of the Pennsylvania system, but the Baltimore & Susquehanna clearly antedates the other.

Other railroads that had some miles put into operation during 1831 were the Camden & Amboy, in New Jersey; the New Castle & Frenchtown, in Delaware; the Mine Hill & Schuylkill Haven, the Mount Carbon in Pennsylvania, and a few others that began nowhere and ended in a similar locality. A few miles of mine tramways were also opened, all showing that the idea of moving heavy freight on rails was appealing favorably to the American people.



DEWITT CLINTON. FIG. 22.

THE MOHAWK & HUDSON RAILROAD.

After the South Carolina Railroad, the next one to come into prominence was the Mohawk & Hudson Railroad. This company was chartered in 1826, but construction was not commenced until 1830. It was opened with ostentatious ceremonies in 1831.

Readers of railroad development often wonder, why one of the most celebrated pioneer railroads in the United States, should have been built away inland, to connect two comparatively small towns, while the great city of New York had done nothing to promote such enterprises. The fact is that in 1830 the city of Albany, the capital of New York State, was relatively a much more important place than it is to-day, and Schenectady was an ancient growing city that expected to advance rapidly into metropolitan dimensions. Albany was at

that time the seventh city in the Union, was the seat of the State Legislature, of the law courts, the principal entrepôt for the farm produce brought in from the fertile valleys extending to Lake Erie, and was the immediate landing place for all the products of the uberous Mohawk Valley.

INDUCEMENTS TO BUILD THE RAILROAD.

The movement of population toward the forests and prairies west of Lake Erie had hardly begun, for there were less than five thousand people settled west of the lakes; but farseeing men perceived that the immense vacant spaces would be filled before many years passed, and it was seen that the route of the Erie Canal would be the channel of western emigration. Railroads, built along this route, were certain to take much of the business of transporting passengers away from the tedious canal which was prostrated by frost a considerable part of the year. So the enterprise of building the Mohawk & Hudson Railroad was a sensible undertaking and received all the financial support required.

The line was only about seventeen miles long, but natural obstacles had to be overcome of greater magnitude than those undertaken by most of the pioneer railroad engineers. John B. Jervis, who had become celebrated for achievements in canal construction, and who sent Horatio Allen to England to study railroad problems, was chief engineer, and he had few equals in the world at the time.

The old city of Albany was built on river bottoms, that had been washed out of the adjoining high lands which form an elevated plateau extending many miles south and west. This plateau had to be traversed by a line going to Schenectady. As the pioneer engineers supposed that a locomotive engine could climb only very light gradients, inclined planes were employed to raise the cars at Albany and to lower them to another low level at Schenectady. The top of the inclined plane at Albany was near the point where the imposing State House now stands.

THE "DE WITT CLINTON."

Early in August, 1831, the Mohawk & Hudson Railroad was ready for operating, and a locomotive called the "De Witt Clinton," built at West Point Foundry, New York, was ready to haul the first train of railroad cars moved in New York State. The appearance of this engine, shown in Fig. 22, is well known, owing to the numerous pictures of it which have been published.

The De Witt Clinton was a four-wheel engine, all drivers four and a half feet diameter, with cast-iron hubs, spokes turned and polished and wrought iron tires. There were two cylinders, 5½x16 inches, set at the sides of the fire-box at an angle of about 30 degrees. They transmitted the power to inside cranked axles on the first pair of wheels. The wheels were connected outside by side rods in the form of double trusses. The most conspicuous thing about the engine was the boiler, which was horizontal, and had a huge dome that overshadowed the rest of the engine. The boiler had thirty copper tubes 2½ inches diameter and six feet long, and was fed by pumps operated vertically by a bell crank. The fire-box had two doors, one above the other. The steam carried was 50 pounds to the square inch. When the boiler was filled with water and the fire-box charged with wood, the whole thing weighed about four tons. When in good working order it was found that the engine would haul five of the small cars then used on a level at a speed of about thirty miles an hour.

CEREMONIAL INAUGURATION OF RAILROADS.

In the year of grace 1831, the American people were beginning to be proud of the achievements in railroad building accomplished by native enterprise and ability, but this feeling had been little manifested publicly. There had been one exception in a public demonstration made in connection with laying the cornerstone of the Baltimore & Ohio Railroad. That had been attended by one of the most magnificent processions of the military and civil associations, trades and professions ever witnessed in the United States. The venerable Charles Carroll, of Carrollton, then over ninety years of age, the only survivor of those who signed the Declaration of Independence, was present, and laid the corner-stone amidst impressive ceremonies.

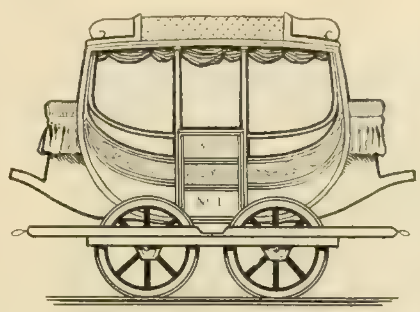


FIG. 23.—FIRST TYPE OF PASSENGER CAR USED ON MOHAWK & HUDSON RAILROAD.

Since that day railroad builders had been contented to begin their work and to inaugurate the operating of their properties in a less ostentatious fashion. But when the opening day of the Mohawk & Hudson was approaching, a movement was instituted to give the enterprise an initiation worthy of the first railroad connecting the capital of the Empire State with the outside world.

The year before, the Liverpool & Manchester had been opened with impressive ceremonies, in which the Duke of Wellington, the hero of Waterloo, and other celebrities took a part. The festivities of the occasion had been clouded by a locomotive running over a member of Parliament with fatal results; but that did not deter the promotors of the Mohawk & Hudson Railroad from arranging for an opening excursion in which the leading celebrities of New York State were invited to ride.

DEMAND FOR A GALA DAY OPENING.

There were many legislators, judges and other public officials in Albany at the time, and they readily accepted the invitation to take a free ride, a practice the politicians of all States have faithfully adhered to ever since. A formidable array of names of men who took part in that excursion is preserved, but time has robbed most of them of the note they originally possessed.

On August 9, 1831, the De Witt Clinton stood on the newly finished track at the top of the inclined plane at Albany with a train of highly picturesque cars (Fig. 23) behind her. They were large stage-coaches with doors at the sides, and to convert them to railroad use the bodies were secured to oblong wooden frames to which the axle boxes were fitted. The ends of the frames acted as bumpers and the cars were coupled together by loose chains. They carried passengers inside and on top.

THE FIRST TRAIN AN EXCURSION.

When the engine was getting up steam, passengers were crowding into the cars until they were nearly as well filled as an elevated railroad car during the rush hours. David Matthew, the engineer, dropped oil on the frictional surfaces, examined carefully every rod and bearing, then mounted the unprotected foot-plate ready to start. John T. Clark, who was the first conductor, mounted to the seat at the back of the tender, tooted upon a tin horn, and this famous cavalcade started. So did the horses belonging to a concourse of farmers who had come in their buggies and wagons with their wives, families, cousins and aunts. No resounding automobile ever spread such consternation around. When the engine gave forth the first exhaust the horses started away in frightful terror.

A gentleman who was in the train afterward wrote: "A general notice having been given of the contemplated trip, excited not only the curiosity of those living along the line of the road, but those living remote from it, causing a large collection of people at all the intersecting roads along the line of the route. Everybody, together with his wife and all his children, came from a distance with all kinds of conveyances, being as ignorant of what was coming as their horses, drove up to the road as near as they could get, only looking for the best position to get a view of the

train. As it approached, the horses took fright and wheeled, upsetting buggies, carriages and wagons, and leaving for parts unknown to the passengers, if not to their owners, and it is not now positively known if some of them have yet stopped."

ON THE TRAIN.

The passengers on the train had their own share of excitement when the engine started, the loose couplings jerked the train so violently that the passengers were thrown into confused heaps clinging desperately to each other to avoid falling off.

The original intention was to burn anthracite in the fire-box of the engine, but a few experimental runs had proven that anthracite would not generate steam fast enough, so it was determined to burn pitch pine. There was no spark arrester, so the force of the exhaust threw out a volume of black smoke freely mixed with sparks, coal, cinders and lumps of half-burned pine. The sparks found their way into the eyes and ears of the passengers, down their necks and into every crevice in their clothing. Those who carried umbrellas raised them to ward off the fiery downpour; but these soon took fire, and the train held a frantic crowd, who slapped out the flames, destroying their own and their neighbors' garments. People by the wayside supposed that the train was carrying a load of maniacs. Consternation reigned supreme, and many people thought of jumping before the engineer perceived the condition of affairs. By that time they were near a water tank, where a stop was made, and the burning garments were drenched with water. Many of the pleasure seekers had good reason to remember their first ride on a railroad train.

LOCOMOTIVE ROBERT FULTON.

As the only public locomotive building works in America at this time was the West Point Foundry, New York, which was of very limited capacity, most of the railroad companies had to order locomotives from England, principally from the works of Robert Stephenson & Co., Newcastle.

Shortly after the Mohawk & Hudson Railroad was opened for business a locomotive called the "Robert Fulton" was received from England. This engine was a modification of what was known as the "Planet" class, the most successful type of engine built by the Stephenson's up to this time. The Planet class proper had inside cylinders placed under the smoke box, cranked axle, of course, one pair of drivers set in front of the fire-box and one pair of small carrying wheels behind the smoke box. Instead of the small carrying wheels, the Robert Fulton had a second pair of drivers, and the wheels were connected the same as the De Witt Clinton. The wheels were four feet diameter, set four and one-half feet apart from center to center. The total weight of the engine in working order was about 15,000 pounds.

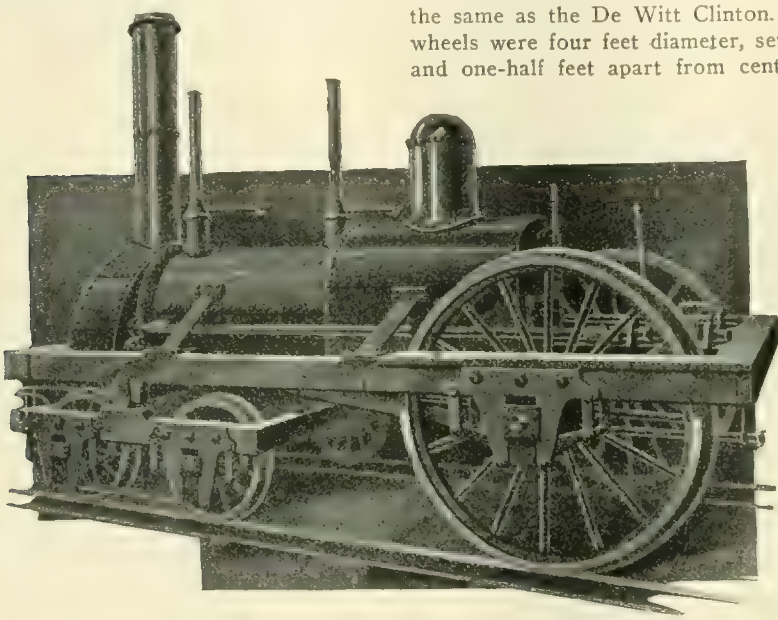


FIG. 24.—JERVIS' "BROTHER JONATHAN."

DEFECTS OF THE ROBERT FULTON.

The engine steamed well and had all the tractive power required, but defects developed which led to the invention of the engine truck. The frame was twelve feet long and the axles being four and a half feet apart, it projected beyond the bearing on the axles nearly four feet each way. This produced an unsteady motion that was very unfavorable to the track, the machinery and disagreeable to the enginemen. It teetered like a short wheel-base horse car. The track of the Mohawk & Hudson was well constructed for that time, being of strap iron laid on southern pine, but the hammering action of the Robert Fulton was too much for it.

INVENTION OF THE ENGINE TRUCK.

Mr. Jervis admitted that heavy engines must come into use and he got cogitating over means to prevent the destructive effects of the Robert Fulton. This led him to propose a four-wheel leading truck. He made drawings for an engine having this improvement and sent them to the West Point Foundry. The engine made from the drawings, which was called the "Brother Jonathan," was delivered in 1832, and worked so well that the English engine was changed, the forward pair of drivers being removed and the four-wheel truck put in front.

David Matthew, who had charge of the building of the Brother Jonathan, wrote about the engine: "She had cylinders 9½x16 inches, two driving wheels five feet diameter, set aft furnace. Truck wheels 33 inches diameter. The truck worked upon friction rollers. The furnace was five feet long and 34 inches wide, made to burn anthracite coal.

"With this engine I have crossed the Mohawk & Hudson from plane to plane fourteen miles in thirteen minutes, making one stop for water."

This will show that claims of high speed began early on the New York Central.

JERVIS ORDERS STEPHENSON ENGINE WITH LEADING TRUCK.

That same year Mr. Jervis sent to Robert Stephenson & Co. drawings and specifications for a locomotive to be built for the Saratoga & Schenectady Railroad. It had a single pair of driving wheels and a four-wheel truck, and this was the first locomotive built in Europe with a truck which they call a "bogie," then the slang name given to small four-wheel service cars. The word is now good English, but it was not admitted into dictionaries in the third decade of last century.

The weak and fragile condition of the track of early American railroads made the leading truck popular wherever it was tried, and it came rapidly into favor. Baldwin used it in his second engine and continued its use, so did the Norris's and other early locomotive builders. It was the most valuable improvement which the New York Central Railroad System bestowed upon the railroad world.

(*To be continued.*)

We have received a letter from W. F. Allen, Argentine, Kansas, in which he takes issue with Mr. Buckbee's letter in the May, 1903, issue of RAILWAY AND LOCOMOTIVE ENGINEERING about the relative merits of the two cylinder tandem compounds. Our correspondent insists that he has a tandem compound which is better than any other kind and very easily kept in piston packing between the two pistons. He does not, however, give any figures to sustain the position he takes.

Trespassers on Railroad Track Have No Redress.

A decision handed down by the circuit court at Akron, O., last month, is attracting much attention among railroad men, and it is also of considerable interest to the general public, especially that portion who make a practice of walking along the tracks of the railroad companies. It was in the case of Stein against the C., A. & C. Railroad Company. Stein was a student at the high school, and while walking along the track of the C., A. & C., just below Center street, he was run down by a C., A. & C. switch engine and badly injured. He sued for big damages and secured a judgment for $2,500 in common pleas court. But last week the circuit court reversed this judgment and ordered the case sent back for a new trial in common pleas court.

Judge Hale, of Cleveland, handed down the decision. He held that where anybody trespassed on railroad property, except at street crossings, they did so at their own peril, provided, of course, they were not run down maliciously, in which case criminal action as well as civil action could be brought. The court held that the engineer need not be on the lookout for possible trespassers on the tracks of the company. Of course an engineer, in case he should see a man on the track, is not supposed to run down the man in case it is possible to stop the train.

This particular case is of special interest in view of the fact that persons for thirty years have been using the tracks between Mill and Exchange streets as a path, and the evidence showed that at times there are as many as 200 persons on the tracks between these streets. Notwithstanding this the persons were trespassers, as the company has signs up warning persons to keep off the property, and consequently persons walking along the tracks do so at their own peril, and if they are injured or killed they or their relatives can recover nothing if the engineers have exercised ordinary foresight, the court held.

Air-Operated Door for Oil Annealing Furnace.

A very satisfactory arrangement for raising and lowering the heavy cast-iron and fire-brick door of a plate-annealing furnace is to be seen in the Elizabethport Shops of the Central Railroad of New Jersey. The furnace is heated by the combustion of oil. Four jets similar to those used in the well-known Ferguson oil furnaces supplied by the Railway Materials Company, have been applied to this furnace by that concern. The hearth is 14x9 feet, and is 20 inches high at the sides, and 26 inches high at the center of the arch.

The door itself is composed of five cast sections with two half-sections, one at each end. The sections are bolted together through a flange on the outside, and are filled with fire-brick inside. The central chain is the one which does the lifting, being attached to a hook operated by a 6-inch air cylinder with about 30-inch stroke. The two side chains pass over pulleys bracketed against the wall and pass outside the wall of the building where two counter-weights, each

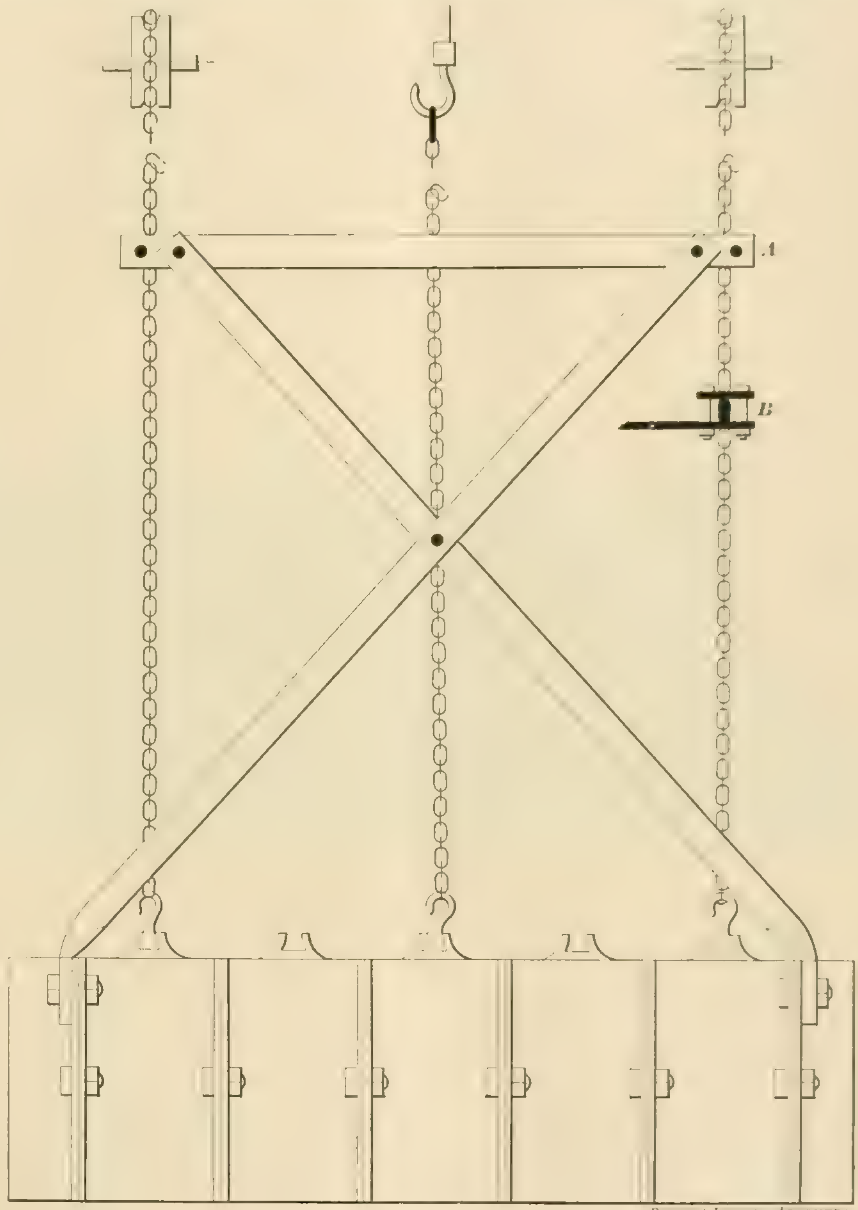


PLATE ANNEALING FURNACE DOOR, C. R. R. OF N. J.

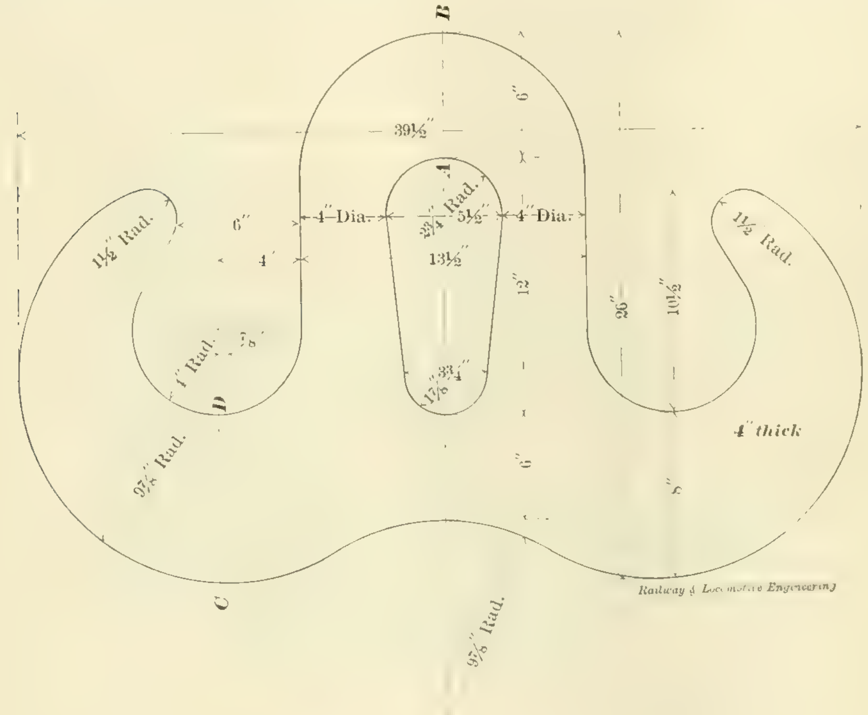
about 400 pounds, balance the door. Over this furnace is a shop window, and the problem was to arrange the raising and lowering mechanism so that the light should not be interfered with and yet that the door should work easily and promptly without sticking or sagging down at one end. These two conditions were met by the construction shown.

The mechanism consists of a braced skeleton frame which offers no obstruction to the entrance of light to the shop, and at the same time makes the long, low fire-proof door equivalent to one of from ten to twelve feet high. Two flat bar iron diagonals, from the door proper, are bolted to a flat, iron cross-brace, as shown at *A*. With the aid of a short iron strap at the back the counter-balance chains are firmly clamped as shown in plan, at *B*. There is no chance for the door to rack or to swing sideways, though the pull which raises it is applied through the center chain. All three chains are secured by dove-tail hooks, slid into dove-tail lugs on the castings. The center chain is quite independent of the skeleton frame. The placing of the counter-weights outside the building does away with the possibility of their getting in the way, and in case of breakage of chain or hook the risk of injury to any employee is entirely obviated. The whole arrangement is planned to secure maximum advan-

tages, with minimum cost, and it gives a positive and satisfactory movement to a door which is otherwise very awkward to manipulate.

Double Hook and Steel Sling Used in Lifting Engines.

The annexed sketch is of a double crane-hook used, together with the main hook, on one of the 50-ton cranes employed in lifting engines at the Elizabethport shops of the Central Railroad of New Jersey. This hook is used in conjunction with a steel wire cable sling, good for 60 tons and about 25 feet long, which is made with an eye at each end. The double hook is slipped into main hook and both the eyes of the wire sling are then dropped in place on the double hook and the sling hoisted until it carries the smoke box of the engine which it is intended to lift. The back end of the locomotive is lifted in the usual way with top equalizing beam, two hangers and heavy carrying bar which passes under the foot plate.



DOUBLE CRANE HOOK FOR LIFTING ENGINES AT FRONT END.

The double hook for the cable sling is made of soft steel, and the whole arrangement is regarded as one of the handiest and quickest methods for taking hold of the front end in a lift. The shop people are not prevented from tackling a hot front-end when necessary, as the steel sling does not take any harm, as a hemp rope might, from surrounding a hot smoke box. The two eyes and double hook together reduce the time occupied in "taking hold" of an engine to its lowest terms, as well as being a safe method. The whole thing has little or no wear, and can be readily hung up out of the way when not in use.

Oil Burners for Boston and Maine.

Among the recent orders received by the American Locomotive Company at Schenectady for locomotives to be built at the local works is one of twelve engines for the Boston & Albany road. Four simple oil-burning engines of the Northwestern type are being built for the San Pedro, Los Angeles and Salt Lake Railroad. They are for August delivery. The locomotives are to weigh 157,000 pounds each, with 90,000 pounds on the drivers, which are to be 70 inches in diameter; cylinders, 19x26 inches. The boilers will be of the straight-top type, 66¼ inches in diameter at the smallest ring, with 326 tubes 16 feet long and two inches in diameter, to stand a working pressure of 200 pounds. The tender will have a water capacity of 55,000 gallons and an oil capacity of 1,750 gallons.

A Diminutive Locomotive.

There is on exhibition in the waiting-room of the Lackawanna at Hoboken a product of the Kingsland shops of the company, which they call the smallest working locomotive in the world. It is not one of the thumb-nail freaks, but a complete working locomotive of particularly small dimensions. It is standard eight-wheel American type, with four coupled drivers. It is 5 feet 4 inches in length, 18 inches wide and 28 inches from rail to top of smoke-stack. The cylinders are two inches in diameter, with a stroke of 4 inches. The boiler is built of steel and has stood a test of 400 pounds to the square inch. The engine complete weighs 600 pounds.

It will be taken to Cranberry Lake, the company's excursion resort, where a track about 1,000 feet long is being constructed, and it will haul a train of ten cars during the summer months. It attracts considerable attention from the thousands who pass through the Hoboken terminal daily, and is especially pleasing to the young folks.

Small as it is, this engine is capable of developing considerable power, and is nearly as strong as the Cooper engine, illustrated in RAILWAY AND LOCOMOTIVE ENGINEERING of February last.

Engines for the Pittsburgh and Lake Erie.

The American Locomotive Works have received an order from the Pittsburgh & Lake Erie for a large number of Atlantic type engines. The machines will weigh 167,000 pounds, with 97,000 pounds on drivers. Diameter of cylinders, 20 inches; diameter of drivers, 72 inches; wide fire box; heating surface, 2,800 square feet; working steam pressure, 200 pounds; tank capacity, 7,000 gallons of water and 10 tons of coal. The special equipment includes Westinghouse air brakes, steel axles, magnesia boiler lagging, Gould couplers, Monitor injectors, Dressel headlights, Paxton-Mitchell piston rod and valve rod packings, Coale safety valves, Economy sanding devices and Nathan sight feed lubricators. This additional power is intended for the increase of passenger business expected in connection with the St. Louis exhibition.

Moundsville, which is a small town in West Virginia, has succeeded in securing an important industry, being a $3,000,000 pressed steel car plant, to manufacture cars and other structural shapes on a large scale. The town has secured the project by giving a tract of 45 acres upon which to construct the plant and making other donations of means, including stock and money. The papers in the matter are being closed up at Pittsburg. Pittsburg parties will be in charge of it. The villagers are jubilant at present concerning the addition to the place, but in about five years they will be doing their level best to overburden the new industry with taxes.

The N. L. Hayden Manufacturing Company, of Columbus, Ohio, have issued a folder dealing with the Tippett Compact Safety Valve for Locomotives. In the circular, the form of construction and the method of operation of this ingenious valve is shown and explained. The sizes, effective area and price of each valve in the series from two to four inches, is given, and the claims made for the compact valve are duly enumerated. The Hayden company will mail the circular to those who write to them for copies.

New York Central Tandem Compound Consolidation Engine.

The New York Central & Hudson River Railroad have lately received some heavy tandem compound freight locomotives. They were built at the Schenectady shops of the American Locomotive Company and are described according to their scheme of locomotive classification as 280C200. The cylinders are 15 and 28x34 ins. and the driving wheels, which are all flanged, are 63 ins. in diameter. The calculated maximum tractive effort of this machine when working compound is about 38,000 lbs., and the ratio of tractive effort to adhesive weight is 4.5.

The tandem principle has advantages and disadvantages like many other things. The most obvious advantages, however, are that the thrust upon the cross-head is delivered by one rod, and that the variation of pressures upon both pistons does not produce any injurious strain on cross-head, guides or rods. One very easily perceived disadvantage is that economy of space demands that both cylinders be bolted close together, which renders the piston rod packing between cylinders hard to get at or repair, however, this defect is in part remedied by placing the packing in a sleeve which is capable of a certain amount of self-adjustment up and down as well as sideways.

The valves are of the balanced-piston type and are driven by indirect connected valve gear. All the driving wheels are flanged, and the two forward ones are equalized with the pony truck, while the two rear wheels are equalized together. The cross-head is of the two-guide type, with upper guide cut out to receive the lip on the upper portion of the cross-head.

The boiler is of the straight-top variety, with wide fire-box, and measures $72\frac{3}{16}$ ins. outside diameter at the first ring. There is a four-inch hand hole in the bottom of the boiler, at the smoke-box end, and there is a fifteen-inch mud drum placed near the throat sheet.

The tender is of the usual water-bottom form under frames of 10-inch steel channels, carried on Fox trucks with side bearings on both trucks. The capacity of the tank is 5,000 gallons, and the coal carried is 10 tons.

The engines present a compact and powerful appearance, and are designed for fast heavy freight. A few of the dimensions are given below:

GENERAL DIMENSIONS.

Weight in working order, 200,000 lbs.
Weight on drivers, 172,500 lbs.; weight engine and tender in working order, 306,400 lbs.
Wheel base, rigid, 17 ft.; total, 26 ft. 3 in.
Wheel base, total, engine and tender, 54 ft. 3 in.
Cylinders, 15 and 28 x 34 in.

VALVES.

Greatest travel of valves, 6 in.
Outside lap of slide valves, 1 in.; inside lap, H. P. clearance, 0 in., L. P. clearance ¼ in.
Lead of valves in full gear, line and line full gear F. & B. ¼ in. lead, ½ in. stroke.

WHEELS, ETC.

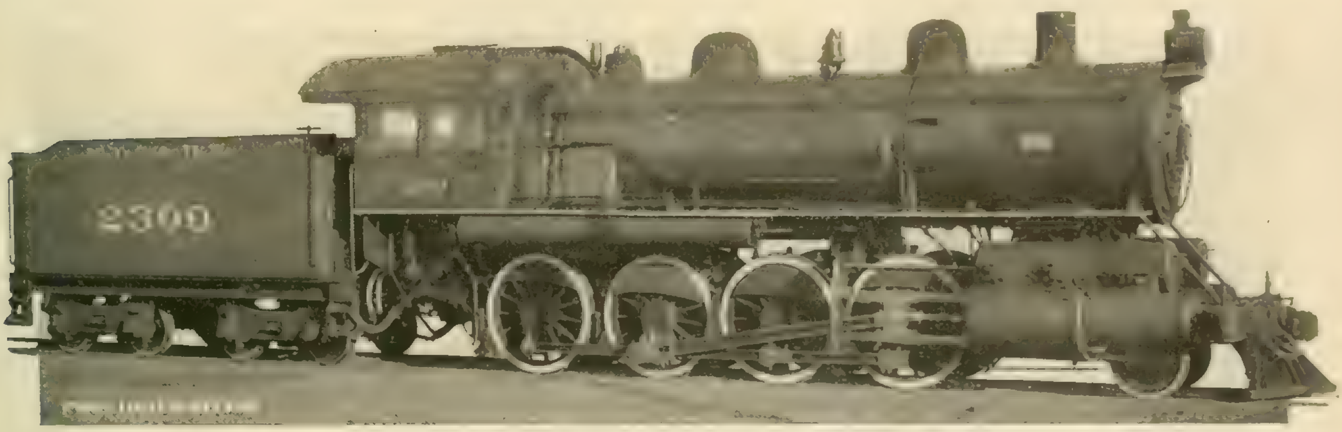
Dia. of driving wheels outside of tire, 63 in.
Dia. and length of driving journals, main, 9½ in., F. & B. 9x12 in.; dia. and length of main crank pin journals, 7½x5¼ in.
Dia. and length of side rod crank pin journals, main, 6½x6 in., F. & B. 5½x4¾ in.

BOILER.

Working pressure, 210 lbs.; thickness of plates in barrel and outside of fire box, [illegible] in.
Fire box plates, thickness, sides, $\frac{5}{16}$ in.; back, ⅜ in.; crown, ⅜ in.; tube sheet, ½ in.
Fire box water space, 4 and 5 in. front, 3½ and 5½ in. sides, 3½ and 4½ in. back.
Tubes, material and gauge, charcoal iron No. 12, B. W. G.; number, 396; dia., 2 in. O. D.; length over tube sheets, 16 ft.
Heating surface, tubes, 3,298.08 sq. ft.; water tubes, 27.09 sq. ft.; fire box, 155.40 sq. ft.; total, 3,480.57 sq. ft.; grate surface, 50.32 sq. ft.

TENDER.

Weight, empty, 44,750 lbs.; wheel base, 16 ft. 7½ in.
Water capacity, 5,000 U. S. gals.; coal, 10 tons.



TANDEM COMPOUND CONSOLIDATION FOR NEW YORK CENTRAL.

A Boom on the Cotton Belt.

Business must be booming on the Cotton Belt Line, for they have recently received thirty new locomotives from the Rogers Locomotive Works. There are seven switch engines, three passenger and twenty freight locomotives. The passenger engines are equipped with cylinders 18x26, the switch engines are 18x24 and freights 19x26. The new, powerful load-pullers are beauties and have a most imposing appearance. A correspondent says: "The Cotton Belt is gradually equipping the system with a fine lot of rolling stock, and in a few years will have as fine a roadbed as is possible to be made in this country. The system is being personally and carefully handled by Mr. E. A. Peck, division superintendent, and his good generalship is having a telling effect. Mr. Peck is considered by all who know him as fine a railroad manager as has ever been in this section. He sees a proposition clearly and quickly, and acts with a natural decision in all matters."

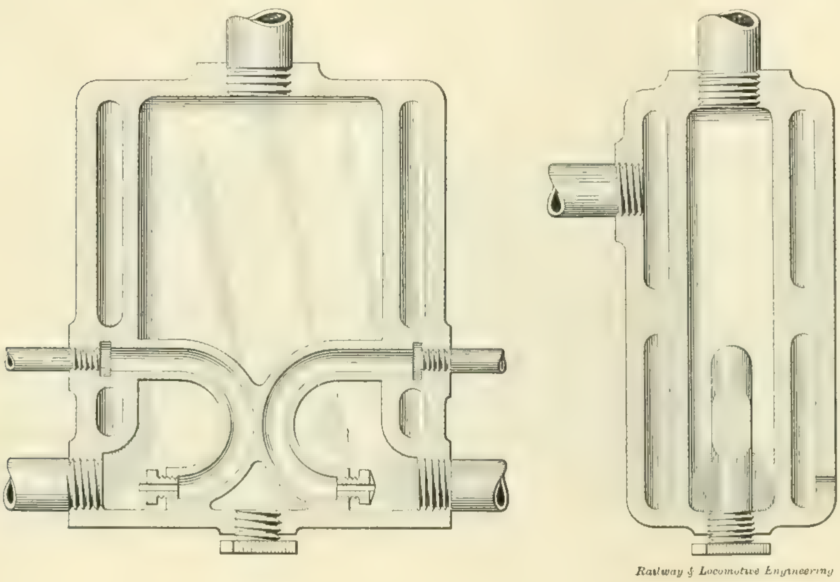
Purposely Misunderstood.

A lady of our acquaintance in Canada, to whom we recently showed with pride a copy of RAILWAY AND LOCOMOTIVE ENGINEERING, fresh from the press, turned over the pages with evident pleasure. Although she disclaimed any technical knowledge of railroad matters she praised the half-tones and line cuts and made some complimentary remarks upon the general appearance of the magazine. On handing it back to us, her eye caught the words "Upsetting Machines," which are printed very conspicuously on the outside of the cover. "Oh," she said, "I did not know you required upsetting machines on railways. Is not that form of entertainment usually provided for passengers without the use of elaborate machinery and generally without much previous preparation on the part of the company?" Just let the delicate irony of the question steal over you, and try to imagine our reply, for it was very good, you may be sure, in fact it was the "acme."

Tears never yet wound up a clock, or worked a steam ingin'.—*Sam Weller.*

Locomotive Sander.

Mr. W. C. Andrews, assistant roundhouse foreman on the Pennsylvania at Altoona, has taken out a patent for a locomotive sander which is shown in our illustration. It consists of a sand-holding chamber which is surrounded by steam pockets, and has the sand-discharging device placed inside the chamber. This arrangement and its construction is clearly shown in the central longitudinal section, being on the left side of the line cut. The view on the right is a central transverse view of the sander. This whole device is connected to the sand box with one feed pipe, through which sand enters the apparatus. A plug at the bottom enables the sand chamber to be cleaned out when required. There are only three parts in the make-up of the sander, the chamber and the two nipples for forming the blowing jet which drives the sand into the pipes leading to the rail. We understand that the device has given every satisfaction, as the sand does not clog, as it is always kept dry by the steam jacket, but it is said that it will work wet sand or such material as smoke-box cinders. It has had a six months' trial on the Pennsylvania and has not failed in that time. It is a very ingenious and compact contrivance.



ANDREWS' LOCOMOTIVE TRACK SANDER.

Cleveland Wants Firemen's Convention.

At the last convention of the Brotherhood of Locomotive Firemen, it was decided to hold the next convention at Buffalo, the people of Buffalo having given all the inducements they could to have the convention held there. We now find that a vigorous effort is being made by the city of Cleveland to induce the firemen to change the arrangements and hold the annual convention at Cleveland. A fund of $20,000 has been raised to entertain the firemen, and the business men of Cleveland appear to think that the inducements will be sufficient to bring them the convention. We hope that the firemen will not be seduced by this offer from Cleveland. Expensive entertainments have been given to several railroad conventions, and they always left a bad odor behind them. There is no convention of railroad men more successful than those which do their own entertaining, and it leaves no aftermath which railway officials can use as a reflection upon the organization. We have in mind one railroad association which received great inducements in the way of a large entertainment fund to go to a certain city with their convention, and it almost ruined the character of the association. Railroad officials held it against the association for years, and it was only by passing strict rules against entertainments that the association in question regained the respect and confidence of the superior officers.

Government Tests of Liquid Fuel.

The Edwards oil fuel board of the United States Navy has been making tests of petroleum for fuel under marine and stationary boilers, and are preparing an elaborate report of the results. They did not make tests under locomotive boilers, but they obtained data of oil-burning locomotives from the Boston & Maine and the Florida East Coast Railroads. It is strange to us that they did not obtain data from railroads in Texas and on the Pacific Coast, where the burning of liquid fuel is an established practice that has been going on for several years, and could provide the very best information obtainable on the subject in this country, at least. Concerning the burning of fuel in locomotive furnaces a report says:

"It may be of interest to note the work done with coal and petroleum as fuel on these locomotives. In each case the engine had its full rated tonnage to haul, and a 30 days' run was taken for the record. On the Florida East Coast Railway, where the road was level, 6¾ gallons of oil was burned per engine mile; the oil weighted 7 55-100 pounds per gallon. The same work with Tennessee coal for fuel resulted in 19.6 miles run per ton of coal of 2,000 pounds. Under these conditions 132.3 gallons of oil equaled a ton of coal. The same engine on freight service, with a heavier load at lower speed, showed 10.6 gallons per mile run, and on coal 13 miles per ton, or 131.8 gallons of oil per ton coal.

"On the Boston & Maine, on the Hoosac Tunnel helper, running double head with coal-burning engine, up grade 42 feet per mile, and returning light, the engine used 11.45 gallons per mile. Oil weighed 7.75 pounds per gallon. Same engine burning coal ran 12.25 miles per ton of 2,240 pounds, and in this service 140.26 gallons of oil equaled 1 ton of coal. In this last test the engines were loaded as nearly equal as could be determined from freight records.

"In conclusion, it may be stated that on the locomotive it was always possible to drive the engine to greater capacity with oil fuel than with coal, and with a smokeless fire. I see no reason why this cannot be done as well in the marine service, and with the work continued along lines following the Hohenstein boiler tests the proper proportions for furnace and boiler settings will be found. In a locomotive from 15 to 25 per cent. of the coal is lost in smoke, unburned gases and cinders, which go out of the stack by reason of sharp exhaust, and there is also a loss of fuel through grates."

Members of railroad clubs in general, and of the New York Railroad Club in particular, will be glad to learn that a libel suit against Mr. H. H. Vreeland, president of the Metropolitan Street Railroad Co., and of the New York Railroad Club, has been dismissed. The evidence brought out in the case shows that certain speculators were doing their best to depress the Metropolitan Street Railway stock, and that Mr. Vreeland publicly expressed his opinion of what they were doing. On this account they brought a libel suit against him, which did nothing but show the despicable doings of the parties who brought the suit. A person must get up early in the morning to get ahead of Mr. Vreeland.

General Correspondence.

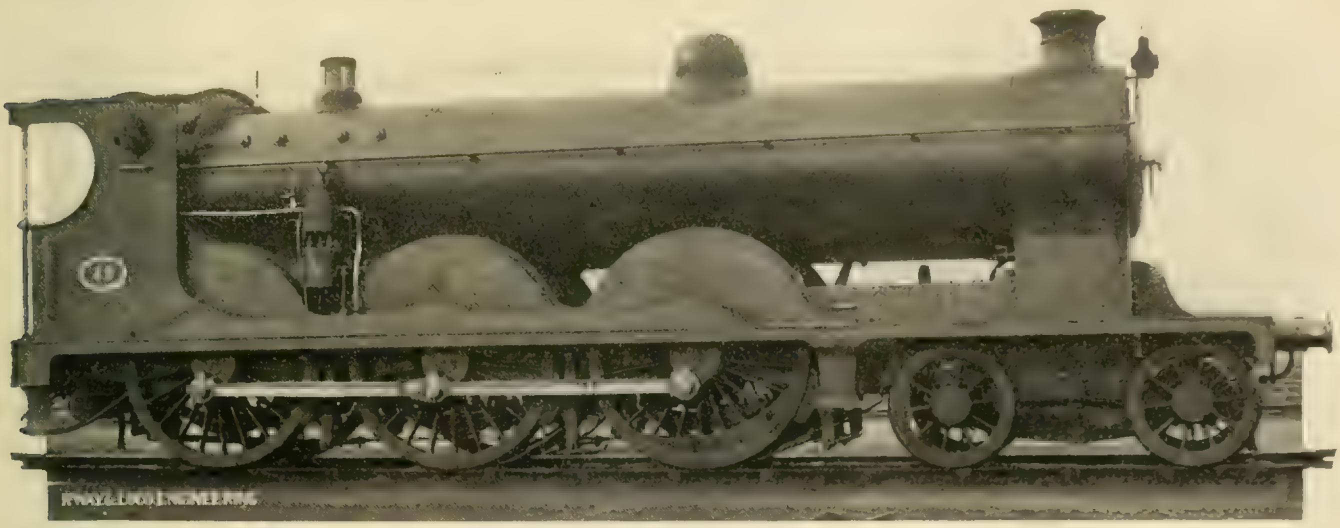
McIntosh's Ten-Wheelers.

Mr. John McIntosh, the locomotive superintendent of the Caledonian Railway, has just designed and completed at the St. Rollox works of the company two locomotives intended for the West Coast express traffic between Carlisle, Glasgow and Perth.

These engines are of a type absolutely unique and new to the railway world, being the first 10-wheeled locomotives for express work which combine inside cylinders, inside framing, a leading bogie and 6-coupled wheels of so large a diameter as 6 ft. 6 in. As such, they mark a step or epoch in locomotive design, and are worthy of special notice.

The cylinders, 21x26 in., are placed between the frames with the valves (ordinary slide) above and actuated by ordinary Howe link motion through a rocking shaft. The boiler barrel is 17 ft., and the fire-box 8 ft. 6 in. in length. The total heating surface being 2,400 sq. ft., this latter could easily have been exceeded, but Mr. McIntosh has used flues of a large diameter for the lower rows, where there is a liability of choking. The working pressure is 200 lbs. per sq. in., and 4 spring safety valves are provided, inclosed in the circular casing above the fire-box. The weight of the engine in working order, as shown, is 165,800 pounds, or greater than that of the average British goods engine and tender combined. The tender, which runs on two four-wheeled trucks, carries 6 tons (2,240 lbs. per ton) of coal and 5,000 imp. gallons of water. At present these are the largest locomotives working in the British Isles, and their performances are giving the greatest satisfaction, handling with ease the heaviest trains put behind them, and though not yet running the fastest trains, promise, when the "shop stiffness" wears off, to "run" with anything on wheels.

S. A. F.



CALEDONIAN TEN-WHEELER.

Setting Slipped Eccentrics.

It was during my first year's service firing a locomotive that I got some very valuable pointers in setting a slipped eccentric.

I was firing a "Hinckley"—go-ahead eccentrics were next to driving boxes. About noon one hot day in mid-summer engine suddenly quit doing business. Engineer of very "stout" build; he was burdened with about 150 pounds of superfluous avoirdupois; quarters were very close under the "Hinckley" for himself and his excess, and he said, "Jimmy" (he always called me Jimmy), "jump under the 'old gal' and see if you can put that eccentric back where it belongs." Being anxious to learn, and at the same time please the "boss," I was soon trying to do business. Unfortunately for me, however, I found the "ear marks" on eccentrics and axle were in a position that made it necessary for me to roll that go-ahead valve crank to top of axle to get it in position. My knowledge of valve motion at that time was very limited, I knew as little about the functions of an eccentric then as I do now of Purgatory. It was necessary for the "plug puller" (inasmuch as he could not get under) to be where he could direct my movements from the outside. Well, I guess I must have got that eccentric to top of shaft, and nearly in position to fasten at least a dozen times when my lever would slip out and that eccentric would glide back to the place "from whence it came." Talk about an orthodox hades, I have my doubts to this day about hell being quite as warm as I found the atmosphere under that engine. I think I would have perished in my attempts to corral the thing were it not for the cheering encouragement that was passed in from the outside. His engineership would say, "put the bar right in there, Jimmy, now pry up a little, now be careful, you'll have her this time," then, by way of sympathy, he would do a little grunting for me. I might here add that the thing was not a bed of roses for his "boss-ship;" his endeavors to keep in position to direct my movements, taken in conjunction with the torrid condition of the atmosphere, was a combination that caused him to perspire quite freely, and even made breathing a task somewhat laborious.

I finally conquered, and, upon my advent from underneath "the old gal," I recollect that my mate in distress said, "I guess *we've* got her at last, Jimmy," and I had just strength enough left to say, "hope to God *we* have." I got my "thinker" to work after I was back on the engine, and I asked myself why could we not have moved the engine one-half turn of the driving wheels? What was to prevent engine backing up far enough to bring marks on axle and back-up eccentric to the mark on its unruly mate? Then I went out in gangway and jammed my "dome of thought" up

against the back-board of cab a few times, and wondered who I had better ask to kick me.

In looking over the different authorities on best manner of setting slipped eccentrics, I find that placing on front center is advised for setting go-ahead eccentric, and I cannot believe that parties who so instruct ever had my experience with one of those refractory necessities that could move freely on the driving shaft.

One of the first things for a locomotive man to learn is, that in all indirect motion engines the eccentric follows the pin nearly one-fourth of a turn back, and such being the case when main pin is on back center, eccentric for the go-ahead motion on that side will have cam on lower side of axle, and there is where you will find it every time should it get loose while in service, and consequently the proper place to put an engine for the setting of a go-ahead eccentric is on back center; if you cannot move engine ahead to get main pin on back center, back her up.

Every locomotive man should make a study of the relative position of the eccentrics to the main pin. Were it not for lap and lead the back-up and go-ahead eccentrics would stand at exactly right angles to the main pin, that is, when engine was on back center the back-up cam would point straight up and the go-ahead cam straight down. With engine on back center and web of eccentric pointing direct towards the earth, the valve is in the center of its travel, and eccentric must be moved toward the pin or fire box far enough to overcome the outside lap and lead (where lead is used). The best rule for setting a go-ahead eccentric is, put engine on back center and if web of eccentric is not already pointing straight down, place it so it will, put reverse lever in forward notch, make a mark on valve stem ⅞ in. from stuffing box, then move eccentric toward main pin until the mark comes flush with the gland, tighten cam and proceed.

If you slip a back-up eccentric, place engine on forward center, this brings the web of your back-up eccentric under the axle; commence business by placing eccentric so it will point straight down, reverse lever in back notch, now make a mark on valve stem close to stuffing box and then move cam toward main pin or links until you have moved mark away from the gland ⅞ in.

Another way would be to place engine on back center, and if eccentric was not already on under side of axle, place it there; then, with lever in front notch and throttle slightly open, move eccentric towards main pin or fire box until steam shows at the back cylinder cock.

For back-up motion, place engine on front center, cam down, lever in back notch, throttle slightly open, move eccentric toward main pin or links until steam shows at front cylinder cock.

Why I advise moving the valve stem ⅞ in. where the distance is measured on valve stem is, that the standard used about the country for outside lap is seven-eighths of an inch, and at this writing the majority of locomotive builders advise line and line, or no lead for full travel of valve, for freight service.

J. W. READING.

Manistee, Mich., April 22, 1903.

Read and Improve Yourselves.

Railroad men have got a better chance to read and improve themselves than any other class of men, and could be the best educated class of laboring men, if they would try. I have reference to the men in road service.

Make the above assertion to some man and what would be his reply? He would say that I have not had time to read the paper for two weeks. He will relate he is so many days ahead of the month and has made so many hours overtime, and ask when have I got any time to read a book or magazine?

Then reason his case and see if he will ever have any time to read. The writer will use his own methods that he borrowed from a friend in his rounds, which are as follows: "Make all the time you can without injury to yourself, work while your engine is out of shop, take the necessary rest in preference to reading; but the time comes to us all when business will be slack or our engine will be shopped for a few days, then catch up with your reading.

How do we pass away our time when our engines are in the shop?

The following is usually the way. After breakfast go to the shop, stay until you tire of that place, then drop into the barber-shop, chat for a while, and, of course, there are other places you can go to on the sly and while away a few hours. You go to those places with practically no intent at all.

That is generally the round every day, but you have no time to read. Why not stay at home and read part of this time? If you are married you would please your family better, or if you are single, you will please yourself better.

Lay a dollar or so by each month for literature. Buy various kinds, read what suits your mood, don't try to read at times you don't feel like it, but cultivate a taste for reading.

Doctors, lawyers, merchants and every other man subscribes for the best journals and books that will give them the best insight to their business to meet their rivals that are in the same field.

What other business are there any more rivalry and competition in than the railroad business at the present age? Don't stick to that old conservative idea and wait for experience.

Prepare yourself for emergencies. Firemen that don't misspend their time never dread the examination for promotion. Time is about all the capital the most of us have, and why not use it to the best advantage?

If you are not a subscriber to RAILWAY AND LOCOMOTIVE ENGINEERING subscribe at once, and never let your subscription run out.

PAT THE ROUNDER.

(The writer of the above letter, who is a general foreman of important shops, raised himself from the fireman's scoop to the position he now occupies by the means which he advises others to adopt. His present position is a rung on the ladder which he will use to reach the top.—Ed.)

What Is the Matter with the Valves?

I am running a geared locomotive equipped with the common D slide valve with ⅜ in. steam lap exhaust line to line $\frac{1}{64}$ in. lead and ¼ in. travel. When the engine is standing still and not on either dead center, by slowly moving the reverse lever I can stop it so steam will slowly come out of both cylinder cocks. The valve looks as smooth as it ever did and the seat is also just as smooth; can any brother engineer tell me why it is, what harm it will do, and how to stop it?

W. T. G.

(The valves and seat need facing.—Ed.)

Wants to Be an Oil Man.

The oil question and the football game are somewhat alike and I think they started about the same time. I don't understand all of the technical points of the ball game. One takes the ball and runs until he falls and all pile on top of him. That is the way the oil question started. Some one saw that there was plenty of room for economy on that one point, so everybody fell on it. I wish some one would conceive a new game that would occupy their attention until we could get the figures set back a little on our oil supp.

The writer holds a position in which becomes one of his fundamental duties t distribute that precious fluid where fri tion exists, and it has caused him a lot extra thought just how to handle it t make it go around, but I claim to b profited by it. It has caused me to stud friction and observe what could be don with a given amount of lubricant, pro vided you don't have a hot pin.

Just imagine what kind of a look and answer the M. M. would give you if you would go in and brace him for a pint of extra valve oil in the presence of the oil man, innocent o' who the latter was. How much love hav you got for the oil man? Answer th question to yourself; but wouldn't yu like to have his job? Ain't it nice to get

free transportation all over the country and your expenses paid at the best hotel just to tell the M. M.'s what engineers should do with the few drops of oil they get? My goal in life at present is to be the oil man. I can imagine myself telling the M. M.'s what I used to do. I would forget about bad water, engines foaming and poor lubricators. I would have my pockets full of tables and data showing what had been done and would have my little song to back it up, and would be able to make the engineer that had used a few more pints than the allowance, feel like a criminal. We want a little more margin, or the writer wants to be the oil man. FOREMAN.

Temperature of Fire Box Sheets.

I have read with interest the several answers to my question in the January number in regard to low temperature of firebox sheets in boilers. Mr. Allen S. Weeks, of Boston, quotes Tyndall's "Heat as a Mode of Motion." I fail to see where this firebox condition is explained in Tyndall's. I have passed my hand over intensely hot pieces of iron and also passed my finger through molten metal, but in this case the moisture that is in the hand will create sufficient pressure to force the metal away from the flesh. But this will not hold good in the case of a boiler or firebox, because you cannot hold your hand on the outside of a boiler for an instant without being burned. Mr. Weeks seems to think I would get burned if I should hold my hand on the sheet long enough. In this he is correct, because the hand attracts the heat to that spot. I have taken an air jet and placed it against the sheet for a few seconds and then removed it and placed my hand on the spot and found it to be very hot. In reference to the teakettle problem, you can hold the kettle on your hand until the water stops boiling, then it becomes hot instantly.

I don't think that the vapor from the hand is a solution, because the outside of the firebox will burn one's hand instantly and the inside won't as long as there is a hot fire in the firebox. When the fire is knocked out and cold air admitted the sheets become hot. I am of the opinion that a large per cent. of the leaks and cracks in fireboxes are caused by using the blower strong while knocking the fire out of them.

Mr. E. W. Gregory, of Hoffmanville, Md., explains it from the soot standpoint. Soot being a non-conductor of heat will protect the hand, but I have also tested that argument by washing a vessel clean on the bottom. I have also tested it in the firebox by cleaning off the sheet before placing my hand on it. The sheet is cool just the same. I have had several solutions sent to me through the mail. A mechanical friend of mine from Chicago gave the following solution: "You were kicked on the head by a mule when you were a small boy, which left you laboring under the delusion that ice could be frozen on a red hot stove." I would like to hear from others on the subject.

W. B. CHENOWETH.

[We do not care to publish anything more on this subject.—Ed.]

Friction.

A great many theories are advanced and received as facts simply on the strength of the reputation of their advocates, as the interests of some might be affected. Hence, it is often many years before the character of either is established. For instance, at a time long ago, it was said the moon was made of green cheese. At this time not many believe it. Gallileo proclaimed the rotundity and rotation of the earth. The Church, and wise men in her interests, denied it. Not many now in the civilized world have any doubts of old Gall's theory. One of the King Georges of England asked his savants why the addition of a live fish to a vase of water would not increase the weight of the whole? One by one, they took up the question, and gave scientific reasons for the phenomenon. One of them, Sir Christopher Wren, asked if his Majesty was sure such was a fact. "No!" replied the king, "I know nothing about it." It was not a fact. Thus it is, some one of reputed knowledge on certain lines advances an idea, and it is endorsed without a question; until, like a soap bubble, it bursts from its own overgrowth.

About 1830, a French mechanical engineer, named General Morin, made the assertion that "friction was governed entirely by the weight of the matter in contact, and not by the amount of surface bearing," and, to this day, notwithstanding the daily evidence to the contrary, scarcely anyone has the hardihood to contradict the general's theory. And some there are who yet maintain its correctness. (Not many, however.—Ed.) With the pulleys in use on shipboard previous to 1840, it required the full crew to hoist a topsail; and the whole watch to shut home the clew. About the years mentioned, a "friction pulley" was introduced into the Navy. It had steel rollers of small size between the pin and bushing of the sheave. With this pulley the watch on deck could hoist the topsails, and the quarter watch could shut home the topsail clews.

In 1847, Norris, of Philadelphia, built for the Reading Railroad a 10-wheel engine. She was a slipper, and on a "bad" rail was of no use with a full train.

When James Millholland became the master mechanic of the P. & R., he took out the leading pair of drivers, hoping, by having the weight (nearly) of the three pairs of wheels on the two remaining pairs, the traction of the engine would be improved by reason of the wheels biting deeper into the rail. After the change she would not pull a half train.

Mr. Millholland, later on, built some engines to drill around the yards and wharves. Many of them were alike in cylinder, size of wheel and weight, but some had six wheels and some only four wheels connected (all tank engines.) The six-wheelers would handle 30 per cent. more cars than the four-wheelers.

In 1884 I had an 11-ton, narrow-gauge engine on a branch running from Timberline, on the Northern Pacific Railroad, just west of the Bozeman Tunnel, to coal mines. The iron was 28 lbs.,


A CALIFORNIA FARM HOUSE, ON SOUTHERN PACIFIC ROUTE.

and I could hardly haul ten empties up the grade on account of slipping. Iron was changed to 70 lbs., taken out of the N. P. track, and engine wouldn't slip a turn with 18 to 20 empties.

The Manhattan Elevated Railroad laid their middle track on Third avenue with iron taken out of main line. It was good enough to store cars on. Much of this iron had been worn out on the curves of the road, and was cut away to the "web;" full half the head was gone. Unfortunately, some of this iron was laid between 89th and 98th streets. When the expresses were put on, somewhere in 1889, they took the middle track at 98th street; as soon as the engine came on this half-head rail, she flew up and stalled. This kept up until full-sized iron was laid, and there was no more stalling from slipping.

When the Ninth avenue tracks were relaid in a couple of days with 90-lb. iron, the engines could not haul their trains. The tire had worn to fit the smaller rail taken out, and only touched the edges of the head of the larger rail. The weight was then all the same, but there was not the surface contact as on the old rail.

I'll close by merely referring to the ball-bearing axle boxes now in use on nearly everything on wheels outside of steam railroads. E. J. RAUCH.

Electricity on Surface Railways.

I see in the current number of your paper some reference to electrification of railways in England. In addition to the cases mentioned, I may say that the Lancashire & Yorkshire are now electrifying the road between Liverpool and Southport, a distance of 24 miles (ceica). The current is to be supplied at 250 volts, and the system is the third rail center conductor. Experiments were carried out at the works at Horwich. The North Eastern are also to electrify a road of 31 miles near Newcastle.

Trusting this additional information will prove acceptable, I can guarantee its accuracy.

H. STATHAIN.

Stratford, Ont.

Why Foreign Locomotives May Be More Efficient Than Ours.

The article in April number of RAILWAY AND LOCOMOTIVE ENGINEERING comparing the performance of American and foreign locomotives, suggests some points that are worthy of attention in our present locomotives, particularly so as regards smoke-box arrangement and heating surface, represented in long flues. The former is already receiving some attention, as the large stacks now being used on some of the wide fire-box engines will testify. As we become better acquainted with the subject, we find that it is necessary to allow the unconsumed gases to escape from the front end freely, otherwise they act as an obstruction to the gases passing from the fire-box into and through the tubes; and the result is incomplete combustion in the fire-box. If we take an ordinary kerosene lamp that is burning brightly and giving off no smoke, and suddenly place an obstruction over the outlet of the chimney, in noting the result we find that the current of air in passing up through the chimney, which is being robbed of its oxygen by the process of combustion, is suddenly stopped, and as the supply of air is limited, its oxygen is uniting with the carbon in insufficient quantities, producing inferior combustion. We will notice the lamp is smoking badly and burning with a dull, red flame, and it illustrates what is taking place in the fire-box of a locomotive whose front end is obstructed by diaphragm plates, fine netting, small stack, etc. It is needless to say that dense black smoke will be seen issuing from the stack and that under such conditions the engine is wasting fuel.

As to the long flues, we might say that a long boiler presents advantages such as a better equalization of weight, etc., and who will say this is not an advantage with some of the very heavy engines now being used? While we know that the heating surface in the forward part of long tubes is heating surface just the same, it is not entitled to the same consideration as that of the back part, which is in contact with the intense heat being generated in the fire-box. As the heat in passing through the thin flues is being rapidly absorbed by the water in the boiler, it is very nearly used up by the time it reaches the forward end of a 16-foot tube. It would hardly seem fair to compare the heating surface of our long boilers with those of foreign build which are as a rule much shorter. It would seem that the conditions and requirements in our railroad service had placed the American designer in rather a bad light in this respect. There is one point I wish to speak of that bears heavily upon the question of boiler efficiency. It is the conditions existing at the fire-box end of the boiler. While I am not familiar with the methods of the foreign builders in regard to it, I am inclined to think they give considerable attention to the admission of air through and over the fire. In order to obtain combustion in the desired form in the locomotive fire-box, it is just as essential to have the facilities for admitting the proper amount of air to the fire as it is to have the smoke-box free from obstruction.

Again, taking the kerosene lamp for an illustration, and this time obstructing the bottom opening of the chimney, we find about the same conditions as before, that of the lamp smoking badly, due to an insufficient supply of oxygen, and illustrates what takes place in the fire-box when not enough air is admitted to the fire. We will then also notice as before that black smoke is issuing from the stack. Now, let us again return to our lamp, but this time remove the chimney entirely. We also find combustion is incomplete, but this time it is of a different nature. Air being admitted to the flame in such large quantities the process of combustion cannot take all the oxygen offered, with the result that the gases are cooled down below the igniting point and pass of unconsumed to a great extent in an invisible form. Here is an illustration of what is taking place in the fire-box when too much air is being admitted, either through the grates or above the fire. As when the grate is only partly covered or the furnace door is left open long enough to supply large quantities of fuel at one firing. In this case the loss does not appear in the form of dense black smoke issuing from the stack, but is more like slightly discolored steam, a greater portion of it being invisible as the unconsumed gases pass out with the exhaust. While we know that complete combustion cannot be expected in the locomotive fire-box, we also know that a general knowledge of the process of combustion when properly applied has much to do with the efficiency of our locomotives.

Possibly our Foreign Brothers have, in designing their locomotives, given more attention to this particular subject than has been the custom with American locomotives of late. It has been my experience to observe many modern locomotives that were not only deficient in the means of regulating the supply of air above and below the grate, but their grates, shaker-bars, ash-pan, etc., were such that it was a difficult matter to maintain a clean fire while on the road. It is also possible that more attention is given this important subject by the foreign operatives, and I am inclined to think the latter has much to do with the excellent performance of foreign locomotives.

There was a time, however, when we had engines in this country with limited heating surface and many other disadvantages when compared with our engines of to-day. I well remember one that I fired in 1886. It was part English, built by Wilson Eddy, with cylinders 19x26 in., and weighed about 35 tons. What the heating surface was I do not know, but I do know the fire-box was so small that a dozen scoops of coal would fill it about full, and that the engine was over-cylindered. Yet, when the rail was good, this engine did excellent work, as did all the others of its class, and steamed well also. Why was it? Simply because the men, particularly the fireman, displayed more skill in the performance of their duties

than at present. While in those days the fireman was not expected to pass examinations on combustion, and he knew but little about the subject, but he made good use of what he did know. And in his crude way he knew how much air was required to make the hottest fire, and when and how to admit it to the fire-box to get the best results. If he did not give close attention to the use of ash-pan dampers, keep the flues clean and grate and ash-pan clear of ashes and feed the fire very delicately, he could not get the steam; and if he did not get it the engineer would not have him on the engine. I can just imagine the result if we were to place the average American fireman of to-day on such an engine as that.

W. A. BUCKBEE.

Rensselaer, N. Y.

Conditions on the Air Line.

BY A. SUP LYMAN.

Fourth Paper.

At 8.30 next morning the local officials of the Air Line, including Thomas Barker, master mechanic; Tom Williams, superintendent; Graham, the trainmaster, together with Turner, ex-supply man once, now grief specialist, met the manager of the road in his car, the 300.

Nine was the hour set by John Stewart for this meeting, but the night's happenings, as told by the wires, seemed to have moved all alike toward the place of meeting, where the situation, the subject of discussion the evening before, was to be gone over more fully.

Two serious wrecks with the loss of three lives was the cause for the well-defined look of care and worry that marked every face except that of John Stewart. That veteran was rapidly examining a pile of matter that lay on his desk, pausing only to dictate a few brief, terse sentences to his assistant, and in a moment he rose, closed his desk, and with a word of dismissal to his clerk, he offered his hand and a quiet word of greeting to his subordinates. The look of mobility that the manager habitually wore, and which was well described by Smyser, who ran the 37 on the Meteor, when he said, "The old man has a face like a poker player. You can't ever tell what he is thinking about," gave no indication of concern at the loss of three engines, twelve cars and, their lading. This was the outward show. Inwardly the property loss had no effect, but loss of life with its resultant effects, widows, fatherless babes, the pitiless questioning of the Coroner's inquest, had a numbing effect, which of late oft recurring he had learned to dread. After a serious accident the "old man" usually took an hour to himself. With a half consumed cigar in his mouth, the ashes whitening his vest, he leaned back in his chair and thought; perhaps thoughts turned to dreams.

The old days came back—when his future was before him—he was running an engine on the Southern then—his first trip was with the wrecker, warm-hearted and sensitive, the sudden screaming of the shop whistle, that pitiless wail that shrieked out the wrecking crew's "call to arms" and brought half a hundred distracted wives and mothers, red-eyed and sobbing, down to the little office where the despatchers worked, cut into John Stewart's soul. But while his heart bled, no man ever got engine ready quicker, and absorbing the contents of a dozen complicated orders faster than the eye could read the words he was off.

After thirty years the memory of those wild rushes was yet fresh. The hasty summing up of the disaster—the dismantled engines, tangled cars, and then the quick, sharp word of command from Hickey, that past grand of wreckers. Why shouldn't he be? He was at it all the time. Then came the tiresome slacking, now ahead, now back, the pile of debris in the cut gradually growing less, and then the awe inspiring cessation of work while hands that were rough and calloused lifted with the tenderness of a girl the remains of a poor unfortunate, laying them down where the glare of the bonfire began to lose itself in the darkness, while the nervous boy operator, his relay box sheltered by a screen of car doors, clicked off "Burns, brakeman, found; body badly mangled;" and the response "I I, send body on four's transfer," came back. The "pinks" that the message boy brought to car 300 at four that morning had kept the "old man" smoking and dreaming in his chair until Sam had called him to breakfast for the third time. At 8.30 he was the keen man of business, the manager of the Air Line, and when the party was settled he looked over toward the supply man and said, "Mr. Turner, how do you account for the mistakes that some of our men make? Our best men seem daft. They are daily getting into scrapes that cannot be reconciled with sanity. They forget schedule trains, meeting points, misread time orders, even forget to flag following trains when stopped between stations, as was the case last night when Second-Thirty-Two struck the first section between Midland and Lawrence—two stock men and one fireman killed. We did not suffer these things a few years ago."

"Oh! they came in with prosperity, pooling, per diem battleships and the other improvements," replied the supply man. "Accidents they are called—nice name that. Given on the principle doctors give a Latin name to death from plain drunkenness—sounds nicer to the relatives. Of course we will always have accidents; the human element will provide for that; even good families have had hangings. Men will forget, but to my way of thinking your numerous accidents of late can be charged to two causes—that is, the most of them—overloading the man and lack of education. In regard to the first cause, all men, like a gallon jug, have their limitations; fill it full of tonnage, long hours, doubles, add a hot driving box, leaky flues and a couple of asthmatic squirts for good measure, and the jug overflows. That's where the Coroner gets in his fees. Don't fill the jug too full. As to the second cause, lack of education is one of the weakest points in our whole railroad fabric.

"The call boys pick the new material for firemen and brakemen, and from the day he first goes out as a student he is left to shift for himself. None too much capital to start with, and that undeveloped, until some day the seniority list puts him 'first out' on local. Look at the copies of accident reports men make. Why their applications in this day of little red school houses on every corner should cut them out. But it don't, and their first lesson is in the line of shirking.

"There is where a good, wideawake traveling fireman would win gold for you. I mean one whose head is not cramped trying to hold in what he thinks. Corrigan, who is possibly your best engineer, 'don't know.' Corrigan can take care of things alone fairly well, breaking in a student fireman in the proper way is less inspiring, perhaps more perspiring work, but it pays, quickly, too.

"Instead of the traveling fireman taking the new beginner in tow the 'old head' who is always looking for a snap takes him in charge. The 'old head' unloads on him and he begins to think that the science of railroading lies in unloading, and as they grow older they find that some of the officials have Bachelor degrees in the art. Then the sanctity that should surround train orders and train movements is never impressed on them. I tell you, Mr. Stewart, and gentlemen, the man who can see hospital beds, widows, orphans, tears and poverty back of "chance taking" and carelessness, will seldom make a mistake. He is the kind of man that wants the work done on his engine, wants good pay and is outspoken, but he is nearly always reasonable and he generally delivers the goods. There's the M. & L., they took up the Brown system at request of engineers' committee. Their superintendent was an enthusiast, promised to make it go, would supervise all bulletins and make every case educative. Well, he forgot his promises or was too busy to look into things, and now a fellow who parts his hair in the middle and buys his collars in pairs does the act.

"Accidents of all kinds look alike to him, so do the men. He deals out fifteen, twenty or forty-five, just as the ratchet drops on each case, without cause or comment. Then he tosses in a few 'days' for good measure. The men are beginning to think that their committee buncoed them. Men, like engines, must be divided into families, and the right kind of parents seated at the head of the table, and then family talks, yes, even prayers indulged in. If you will draw the line at each freight division terminal, give each family their own engines, their own trainmaster and traveling engineer, a friendly rivalry between families will soon spring up, and if you have a good man at the head of each department to hold things even you will see some changes.

"You have the State officers, good ones too, but Grayham, Casey and Smith are the only township heads you have, and they cannot touch things. One thing sadly needed is a reorganization of your examination system. As it is handled now it is a farce.

"Your examiner is taken from his regular line and brought face to face with thirty or forty firemen at one clip, all of whom you need so badly that he cannot afford to refuse to pass anything but the very worst. Men are like children on the school question. They pass up the educational question until they are 'next,' then they rush around and find Congor, buy RAILWAY AND LOCOMOTIVE ENGINEERING, glance at a couple of copies and brace the examiner. They don't fail, because you can't afford to let them, but how they decorate the hard luck sheet for the first couple of years while learning the business is a caution. What you want is a semi-annual progressive examination covering three years. Lead them up by stages; in that way men will learn something every day and call you blessed for forcing a good thing on them. Have it understood that on the first six months' service and study will depend the matter of the student's remaining in your employ. Make it a condition of entering your service that this period is purely a probationary one; the brotherhoods will indorse that, it insures them good material. Did it ever occur to you on that line that the officials are the men who handle the ballot box in all the railroad brotherhoods? They have to take what you give them."

The supply man had the floor with a vengeance. Involuntarily leaving his chair he had moved forward and was leaning over the general manager's desk, the unlit havana littering the old man's Wilton carpet.

"Unfortunately this organization costs," the general manager remarked, "and we have our limitations. The men have asked for a revision of their contracts next month, and that means they want more pay. I suppose we will have to give them something, too, and if we were to add an extra official organization on top of that I am afraid our Boston people would kick."

"I have talked to your best men on that question," replied the supply man. "What the men on the Air Line want is a job. Do you know the improper distribution of men and power is close to the wage question? Men who are busy seldom think of a 10 per cent. raise, it is the fellow with a $140 job who draws $50 or $60 that keeps the pay question up in the air. Summing this thing up, Mr. Stewart, an organization is what we want. We will always be short until we get one. It is possible that dividing the engines on a class basis with the view of maintaining supplies and making running repairs is of as much importance to the company as is that of Casey's putting a black eye on my friend Grayham's tonnage performance—general results should be kept sight of."

As the supply man took his seat the general manager rose, saying, "Gentlemen, I meet the State Board at 11. I think we will have to organize on the lines Mr. Turner suggests." Turning to Mr. Barker he said: "Don't let go of the young man, Tom; figure out what place you want him in and we will talk things over later."

As the party left the depôt, going toward the hotel, the supply man turned to his old friend and said: "Where does the best squirt on earth come in. I came down here to sell a few, and instead I find myself the president of a revolution."

"I'll Save This Train."

"What sad and stormy times we sometimes see when out upon the road," remarked the engineer; "and none of us, not one, knows what moment may be our last. I myself have been lucky, for I've never been in but one accident, the one where Engine No. 1319 went through Swan Creek bridge. Old John W. Bruce was engineer the time of the Swan Creek wreck, and I was firing for him.

He was a queer old boy, much given to religion after his little girl died, and although all the boys thought well of old John, they often used to chaff him on this subject. He wasn't much of a talker when on duty, but the night of the accident we were running the Sunset Limited, and he turned to me, this side of Swan Creek, and said:

"George, I suppose the boys don't mean anything when they make remarks about my religion, but they hurt my feelings more than they have any idea of. I never took much stock or interest in religion before my little girl died.

"One night," he continued, "at home, I was sitting by her bedside, looking at her lying so quiet and still, and somehow I broke down and began to cry like a little baby. Well, she just rose straight up in bed, and putting her arms around my neck, said, 'Don't cry, papa, I am going away, I know, but I'm going up to Heaven, and some time you'll come up there to live, too, won't you, papa?'

"I say, George, I made up my mind then and there that if trying would do it, I'd try."

Here John blew the whistle for the curve. As he looked ahead I saw him give a start, and glancing through the front window I saw a sight that took away my breath. The trestle over Swan Creek, only a few hundred yards away, was on fire. In an instant I sprang for the gangway, and reaching it turned to see if John were following me.

"Jump! jump for your life!" he shouted as he saw me pause. "And you?" I asked. "My place is right here in the cab," he replied. "I'll save this train if I lose my life in attempting it!"

I waited for no more, but gave one good leap that landed me in a swamp below. I had hardly come to my senses and got my footing when I heard a crash and saw the engine go through the trestle, leaving the tender hanging upon the edge of the break. John Bruce had been true to his word. He had saved the train, though it cost him his life, for when we picked him up from the wreckage he was dead. It takes courage and nerve to face death like poor John did, for the sake of saving the lives of others. Somehow I can't help thinking that John Bruce must have met his little girl in Heaven. If he didn't it wasn't because he failed to try.

WILLIAM F. EBERWEIN.

A new device to prevent a railroad wreck is being tested by several of the big railroad systems. It consists of an electrical equipment, applied to the rails and locomotives, designed to stop moving trains in a very short space. It is claimed on behalf of the invention that it automatically shuts off steam, releases the air brake automatically, sounds an alarm and lights a warning signal in the locomotive cab, permits telegraphic communication between trains and needs no third rail. The invention is the work of Pittsburg men.

The employees of the American Car & Foundry Co. made trouble for their employers some time ago because material made by non-union men was employed in building cars. The company agreed to unionize their shops and reduce the working hours to nine hours a day, reducing the wages in proportion. This has led to another strike, as the men will not stand for a reduction in wages.

Inspection Car for the Rochester & Pittsburg Coal & Iron Company.

The Baldwin Locomotive Works have recently supplied the Rochester & Pittsburg Coal and Iron Company with an inspection car with small locomotive inside. The engine occupies the forward part of the car and partitioned off it, is a handsomely furnished passenger compartment, finished in green and gold, with mahogany trimmings. The furniture includes a mahogany desk with revolving chair, a leather couch and half a dozen wicker easy chairs upholstered in green plush. Closets, washrooms and lockers are conveniently located.

The cylinders of the simple little engine are 9x16 in., and the driving wheels, of which there is only one pair, are 54 in. in diameter. The leading truck is of the radial type, and all the engine's wheels are equalized together, with three springs in all, the center one lying in a sort of box equalizer, composed of two side plates with blocks bolted in place to take the ends of the springs. The cylinder is placed at the fire-box end of the engine, and the dry pipe therefore comes out of the back sheet with tee-pipe above the fire door, and one branch pipe running down in a curve which just avoids the door. A cross branch pipe supplies both steam chests. The valves are the ordinary D slide, and they are actuated by indirect connection in the usual way.

The boiler is 40 in. in diameter, and has 144 tubes, 5 ft. 6½ in. long, and the total heating surface is 360 sq. ft. The rigid wheel base is 6 ft. 2 in., while the wheel base of the whole car is 28 ft. 3 in. The driving wheels carry a weight of 25,400 lbs., the engine truck carrying 23,200 lbs., while the car truck at the back sustains 24,000 lbs., making a total of 72,600 lbs. in all. A water tank hung under the framing of the car holds 500 gals.

A small dynamo in the engineer's compartment furnishes electricity for two head lights, and sixteen incandescent lamps in the passenger compartment. Electric signal bells are provided, and a solid door shuts off passengers from engineer. The platforms are arranged for observation purposes, having movable step covers. The whole machine is an example of a very completely appointed observation or inspection car.

AN IDEAL INSPECTION CAR.

More Room for the Baldwin Locomotive Works.

The Baldwin Locomotive Works are badly crowded for want of room by being in the middle of the city of Philadelphia. When a large building is put up it is often necessary to close streets permanently, and the politicians of the city find the proposal to close a street a very good subject on which to ventilate their patriotic sympathies, and at the same time reach out for a little boodle if it can be drawn from the company to be benefited. Lately there has been a struggle to close Taney street in the interests of the Baldwin Locomotive Works, and they have at last succeeded. Mr. S. A. Vauclain, the vigorous general superintendent of the works, says in connection with the closing of the street:

'We want the land to give us room to construct a suitable building in which to take care of our locomotives preparatory to shipment. The works this year will turn out between $9,000,000 and $10,000,000 worth of locomotives. We have 35 per cent. of our army of workmen living in the Fifteenth Ward, in which the works are situated, and I think the proposed building will be an improvement to the ward."

The difficulty in obtaining new locomotives on prompt delivery has excited a feeling among railroad companies that they ought to build their own engines. The Chicago, Milwaukee & St. Paul Railroad appear to be making genuine preparations to build their own [illegible] and now we learn that the Chicago, Rock Island & Pacific Railroad System propose putting up locomotive building works at Moline, Ill. We do not believe that railroad companies can build their own locomotives as cheaply as they can buy them, but it is very likely that the experiment will again be attempted.

150 Miles an Hour.

At Elizabeth, N. J., there is under construction an electric car which, it is stated, will make 150 miles an hour.

A Mr. Zimmerman, in the interest of the Aurora, Elgin and Chicago Railroad, is now at Elizabeth supervising the construction of the car, and he predicts that it is only a short time until the twenty-hour Chicago train will be considered commonplace beside these new space-destroying cars.

The car, now almost finished, will be equipped with four motors of 126 horse power each. They are built of steel and are equipped like Pulman vestibules. The interior is finished lavishly in quartered oak and rich hangings.

Allis-Chalmers Company.

Allis-Chalmers Company, Chicago, desires to announce that after May 1, 1903, the general offices of the company will be located in the New York Life Building, 14th floor, corner of La Salle and Monroe streets.

A press dispatch to the New York *Times* from Milwaukee says: The Allis-Chalmers Company and the Christensen Engineering Company have practically decided to double the size of their great works. A small estimate of the cost of this expansion would place the figure at nearly $300,000. The Allis-Chalmers new works, which have just been completed, cost between $2,000,000 and $2,500,000. The work of the Christensen Engineering Company cost $600,000.

Railway and Locomotive Engineering

A Practical Journal of Railway Motive Power and Rolling Stock.

Published monthly by

ANGUS SINCLAIR CO.,

174 Broadway, New York.

Telephone, 984 Cortlandt.
Cable Address, "Loceng," N. Y.
Glasgow, "Locauto."

Business Department:
ANGUS SINCLAIR, President.
FRED M. NELLIS, Vice President.
JAMES R. PATERSON, Secretary.

Editorial Department:
ANGUS SINCLAIR, Editor.
F. M. NELLIS, GEO. S. HODGINS, JOS. A. BAKER, Associate Editors.

Advertising Department:
Eastern Representative, S. I. CARPENTER, 170 Summer St., Boston, Mass.
Western Representative—J. A. BAKER, 1204 Monadnock Block, Chicago, Ill.

British Representative:
THE LOCOMOTIVE PUBLISHING CO., Ltd. 102a Charing Cross Rd., W. C., London.

Glasgow Representative:
A. F. SINCLAIR, 7 Walmer Terrace, Ibrox, Glasgow.

SUBSCRIPTION PRICE.

$2.00 per year, $1.00 for six months, postage paid to the United States, Canada and Mexico. For other parts of the world, $2.50, or ten shillings. Single copies, 20 cents. Remit by Express Money Order, Draft, Post Office Order or Registered Letter.

Mailing address can be changed as often as necessary—always give old and new address, and if you subscribed in a club state who got it up.

Please give prompt notice when your paper fails to reach you properly.

Entered at Post Office, New York, as Second-class mail matter.

The Significance of Block Signals.

"During 1902 in Illinois there were 138 derailments at interlocking plants due to trains running against signals." These words occur in the printed proceedings of the Railway Signaling Club, and were recently spoken by Mr. H. C. Hope, of the Chicago, St. Paul, Minneapolis & Omaha Railway. He pointed out that this statement gave food for reflection, for he continued, "if trains run against signals when derailment is the penalty, we must infer that a much larger number is run where there is no penalty or detection except in case of disaster." The speaker attempted to account for this state of affairs by asking the question "may it not be that the engineer who allows his engine to be derailed, does so through a certain carelessness in his nature, developed by continued disregard of signals where there is no penalty attached?"

If these statements are true, the indictment lies pretty clearly at the door of those who are responsible for the discipline of the road, because it may be accepted as almost an axiom that on any road where an important rule is habitually disregarded by the men, the officials of the road are to blame. There is, however, an individual responsibility carried by every man who passes a signal set at danger which he cannot evade, and every such passing of the outstretched danger arm tends to produce an effect which may one day recoil upon the head of the man who is guilty of disobedience.

The block signal is essentially an "information giver." It conveys certain definite information without causing any uncertainty. It tells the enginemen of the occupation or the non-occupation of the track immediately in front of him. If the company employed men at intervals along the line, able to communicate with each other, and if they furnished information concerning the road ahead by word of mouth, in a yes and no form, it would be in essence the same thing. The block signal is information given by one who knows to one who does not know. It is the guarantee by the company to the man on the engine that either the line ahead is clear or that it is dangerous to proceed.

Men who have run for years on a road on which there are no block signals, naturally acquire the belief that as the track is continuous between stations, so the right given to them by the time-table or by train orders is, in a sense, the right to make a continuous run. An engineer on such a road, running a passenger train, not timed to stop except at important stations, expects everyone else to keep out of his way, the road is his for long stretches, and to stop him is a grievous offense.

This general conception disappears completely with the advent of the block signal. The road is not his for long distances, but is his only for the short space which constitutes the block which he has legitimately entered. The capacity of the road has been increased and other trains are permitted to be closer on his time with the increased protection now afforded. His trip is not necessarily made up of long reaches of unbroken speed. He is now given surer rights only over short distances. Formerly he was a wholesale trader, now he is only permitted to deal in retail bits of the right of way. With the installation of the block signal, the rules of the game have changed.

One result of disregarding a stop signal is to substitute the "I think" of the man for the "I know" of the signal. To do that cheapens the value of the indication at once and introduces that element of ambiguity in train or track rights which is justly the horror of all engineers. The reducing of the full strength of the signal's meaning by successfully disregarding it, goes on whether detected or not or whether followed by accident or not. The real danger point about the whole thing lies in the fact that there are always some men on the road who will believe that the rule is absolute where they themselves require protection—men who will assume that the regulation has been faithfully observed by others and will act accordingly. In such cases when the rule has been disobeyed, the man who is protectd by signal, and who is safe, by all the rules of the road, may yet stand in very jeopardy of his life. Nowhere is the power of example more surely felt than in the behavior of men on railroads. The disregard of signals by even a few men, though not officially detected, produces an effect which is wholly evil, and from which, in time of emergency, there may be no escape.

A story taken from Greek mythology, briefly outlined here, telling of Actaeon, the hunter, may serve to illustrate the position of a man who having assisted in developing a certain state of affairs for his own satisfaction, may at length fall a victim to the very forces he has helped to call into being.

Actaeon with his hounds roamed free and far. He had brushed danger aside many times. His fifty dogs, selected from the best stock, he had trained to follow, and had hardened to endure by long practice, and strong, indeed, and fleet was the quarry that could escape. One day Actaeon trespassed too far, and surprised Dianna and her nymphs bathing in a river. The enraged goddess of the chase changed him at once into a stag, and he was pursued and torn to pieces by the very pack he had so carefully trained and had so successfully led.

The arguments and the pleas for what, shorn of all specious covering, amounts to a desire for more than one meaning to a danger indication, may be skilfully put forward, and may be made to look as if in the interest of the rapid handling of traffic, however they may appear, or however seemingly strong they may be, these arguments are wrong and false in principle. As Actaeon was pulled down by his own dogs, so may a man who has successfully passed danger signals for years suddenly find himself in the grip of circumstances where life itself may depend upon the absolute integrity of a rule which he has often set at defiance, and which by his example he has actually taught others to disregard. No man can reasonably hope to escape from the legitimate consequences of his own deliberate acts.

More Men Needed on Locomotives.

An agitation is kept up in several of the Eastern States in favor of putting an extra man on each locomotive for the purpose of watching signals, and thereby preventing collisions. We think that a third man is badly needed on many locomotives, but his duties ought particularly to be that of assisting the fireman, whose work is becoming too heavy for one man. On some railroads there is already great difficulty experienced

in obtaining firemen for some of the locomotives now in use. The introduction of the new heavy engines is responsible for the lack of men. The men are required to shovel from twenty-five to thirty-five tons of coal each way on the division, so that on a full trip both ways the average fireman shovels nearly seventy tons of coal. The men come home completely played out, and probably before they have had time to secure the necessary amount of sleep they are called out on the road again. This continual wear soon takes the ambition out of a fireman and he quits. On one of the roads in this city I know a young fellow who is only 16, and imagine him trying to fire one of those large engines.

The evil should be remedied by the roads placing two firemen on each of the big engines and that certainly is not too much. Some of those large engines would keep two men busy enough to maintain the correct gauge of steam during the entire run, and then the roads would not have to suffer so much from engines "lying down" on the trip. Unless the operating departments make some general changes in this regard they are likely to experience serious trouble in replenishing the ranks of the firemen, who cannot stand the pressure.

The Longest Tunnel in the World.

Readers of history are familiar with the name of the Simplon pass over the Alps made famous as the route over which armies were marched first by Hannibal and two thousand years later by Napoleon. It is the natural route between Switzerland and Italy, although railways have chosen two other passes for their routes. The Simplon will soon enjoy its natural advantages for they are driving a tunnel through the mountains under the pass which will be fourteen miles long.

The United States Consul at Genoa visited the place lately and writes: "I have recently made a visit to the Simplon, in order to ascertain the character and progress of this stupendous undertaking, whose success or failure means so much for the future of Genoa. Last March, upon the authority of an American engineer, I stated that such serious obstacles had been encountered in the south side of the tunnel that no progress was being made, and that the location of the line would probably have to be changed.

"My examination, on the spot, removed all doubts on this score. The work is progressing rapidly in the tunnel on both sides of the Alps; about 4,000 workmen are employed in the tunnel and not less than 6,000 on the Italian section of the road between Isella, at the mouth of the tunnel, and Arona, the present terminus of the railroad running north from Milan. It is now practically certain that the road will be completed within the estimated time—that is to say, by July 1, 1905—as nearly two-thirds of the tunnel was finished on July 1, 1902, and the worst obstacles have already been met and mastered.

"The greatest of the impediments was the ever-increasing heat in the tunnel. The volume of water flowing out of the south end of the tunnel is over 15,000 gallons per minute, and furnishes motive power sufficient not only to work the refrigerating apparatus, but to compress the air by which the drills are operated.

"This tunnel, when completed, will be the largest in the world—to wit, 14 miles long, or twice the length of the Mont Cenis and five miles longer than the St. Gotthard. The cost of the tunnel alone will be 70,000,000 francs ($13,510,000), an average of nearly $1,000,000 per mile."

Center Plates and Side Bearings.

There has been something of a controversy among car men since the arrival of the heavy cars concerning the advisability of relieving the center plates of a car of part of their load by transfer of same to side bearings that shall have a low frictional resistance; this proposal being made with the view of giving greater freedom of truck action on curves, eliminating the danger to wheel flanges and rail, and reducing train resistance. The so-called frictionless side bearing is said by its advocates to be the correct solution of the weak bolster question on old equipment, and is also urged as the proper treatment for cars yet to be built, making the bolster problem an easy one for the tyro to negotiate. From what has been said and written about this simple solution of a vexatious situation, it is gathered that side bearings having rollers, or perchance balls, are friction annihilators of such a degree of efficiency as to force their way into use against a prejudiced opposition. Such bearings are correct in principle and would admirably serve their purpose in a side bearing, but there is a large contingent who cannot be made to see the need of such a device on bolsters, they arguing that the intimate relation existing between bolsters and side bearings forbid any consideration of the latter without first taking proper cognizance of the former. When this is done it will be noted that tens of thousands of cars are running to-day with bolsters so weak that side bearings are in solid contact when car is light, and the frictionless party would appear to have the best of it. The wheels on those cars are giving evidence anything but mute, of the power required to move them on curves. This result is certainly in consonance with a law of mechanics which provides that a resistance acting through a long lever arm requires more force to overcome it than when acting through a short lever arm, and is well exemplified in the case under consideration, where with center plates of average diameter and side bearings of the usual distance between centers (56 to 60 inches) we have, when side bearings of the plain type are in contact, a resistance to curving practically five times as great as when side bearings are clear; since the wheel flange must absorb the force necessary to overcome that resistance, it is plain that it accomplishes that function with disaster to itself and rail. To correct this tendency to flange wear, the frictionless side bearing is evolved with its saving grace to the weak bolsters, which stand as object lessons of mechanical misfits, and thus bring them to a condition of renewed usefulness at a small financial outlay. The accuracy of reasoning of the sponsors of the frictionless idea does not, however, appeal to its opponents, since it is claimed by them to have the appearance of an attempt to get results with regard to the prime need of the case, which is clearly from the bolster man's standpoint, to keep the side bearings apart, and introduce the frictionless idea at the center plates. There would be little advantage in this construction if measures were not taken to correct the weakness of the bolster, and this, it is claimed, cannot be done with cars now in service, for the reason that sufficient room is not available without redesigning bolsters for both body and truck; such a move would, of course, involve an expenditure that would be prohibitive, hence the plausibility of the frictionless side bearing argument.

If it were not within the possibilities of mechanics to make these old weak bolsters hold up, then would the above be accepted as something more than makeshifts, but it has been shown that any weak bolster may be strengthened most efficiently at a nominal cost, by the use of truss rods, as was done a few years ago on the Chicago & Northwestern Railway. When old bolsters are thus stiffened and new ones properly designed, the ball-bearing center plates leave little to be desired in the way of reducing truck resistance on curves.

The Master Car Builders' committee on side bearings and center plates reported a series of tests in 1902 that gave most convincing data on the necessity of reducing center-plate friction. That portion of the report furnished by Mr. L. H. Turner, superintendent of motive power, of the Pittsburg & Lake Erie, is given in part as one of the most valuable exhibits of the subject on record. The car tested was equipped with the Hartman ball-bearing center plates and side bearings, and had been in service three years, and was a comparative one with the flat center plate and side bearings. A dynamometer was used to determine the resistance to overcome in order to displace the truck two inches

at the end or four inches in its length, corresponding to a 154-degree curve.

FIRST TEST.

That center plate and side bearing, with 1/8-inch deflection of body bolster resting on side bearings:

Required to start truck.... 800 lbs.
Required to displace truck two inches..............1,100 lbs.

SECOND TEST.

Flat center plate, without side bearing:

Required to start truck..... 275 lbs.
Required to displace truck two inches............... 525 lbs.

THIRD TEST.

Hartman ball-bearing center plate and side bearing, with 1/8-inch deflection of body bolster resting on side bearing:

Required to start truck..... 75 lbs.
Required to displace truck two inches................ 450 lbs.

FOURTH TEST.

Hartman ball-bearing center plate without side bearings:

Required to start truck..... 75 lbs.
Required to displace truck two inches............... 325 lbs.

The above figures tell an eloquent story of what may be accomplished by reducing friction at the truck. The wheels showed absolutely no flange wear in three years of service, which fact in itself would have been convincing evidence that the center plates used met all claims made for them, and the many cars since equipped with them is their endorsement. Mr. Turner advocated the use of the roller side bearing for curves of high outside rail elevation, but for straight and level track the ball-bearing center plate would meet all requirements alone. The results of the fourth test leave no room for doubt as to the advantage to be had by carrying the load free of side bearings.

To Make Something Out of Nothing.

A company has been organized and incorporated with a capital of $5,000 for the purpose of what the promoters call a hydroilogen engine, which as usual, is going to revolutionize the methods of producing motive power. They promise to greatly reduce the cost of power by the peculiar way the engine is to use the fuel. The public announcement declares "that this has been accomplished in the new engine by the use of low-grade fuel or crude oil, preferably Texas oil, water and air; gasifying the oil and decomposing the water into hydrogen by mechanically combining and mixing them with air, heated to an intense degree by heat that has hitherto been wasted in modern engines, and thereby increasing the expansive efficiency of the resultant gases of the elastic body."

That is rather a vague description of what the promoters of this engine expect to do, but vagueness is a very good attribute when they are trying to obtain subscriptions to a stock company. That thing of gasifying water to burn hydrogen is an old experiment, and has been used to deceive, not a few times. The people who advocate economy of heat by a method of this kind take good care to conceal the fact that the amount of heat expended in converting water into its original elements is more than equal to the heat which will be reproduced from the operation. When the General Hydroilogen Engine Co., organized under the laws of New Jersey, begins inviting people to subscribe to the stock, we advise our friends to keep severely away from it.

If the principles of natural philosophy were the popular study they ought to be, it would be more difficult than it is for promoters of what are really perpetual motion schemes, to cheat people by using senseless gibberage as a description of operations which they allege are inventions or discoveries. Water is a combination of oxygen and hydrogen, and has the same relation to its elements that the products of combustion have to fuel. Water is the dead product of two gases, which have great potential power when separate. Hydrogen gas makes, in combination with oxygen, the hottest flame known to nature, and when they combine together the product is water, just as the product of the combustion of carbon by combination with oxygen is carbon monoxide or carbon dioxide. The products are inert gases, good for no useful purpose until worked back through nature's laboratory into wood and grass.

To give new vitality to water the product of oxygen and hydrogen is an expensive operation. It requires the same amount of heat to tear the combined gases asunder that was produced by the combination, and there is always loss in carrying out chemical combinations. When weighed deliberately, the Hydroilogen Company propose to increase the heat value of fuel by wasting part of the heat produced in an endless chain process.

Book Reviews.

Hardening, Tempering, Annealing and Forging of Steel, by Joseph V. Woodworth. Publishers, Norman W. Henley & Company, New York. 1903. Price, $2.50.

This work from the pen of Mr. J. V. Woodworth, author of "Dies, Their Construction and Use," contains 320 pages of reading matter and has upwards of 200 illustrations and like other modern technical works contains a good index. It deals with the heating, welding, forging, annealing, hardening and tempering of steel. It goes into the subject of tempering steel tools such as milling cutters, taps, dies, reamers, punches, dies, etc., also shear blades, saws, fine cutlery and metal-cutting tools of all descriptions.

The important question as to the best use to which the leading brands of steel are adapted is concisely set forth, and the method of working them under different conditions, and also the methods of tempering and hardening the special brands. A number of "kinks" and "practical points" are given in this connection.

Case hardening is taken up and special reference is made to the adoption of machinery steel for tools of various kinds.

At the back of the book there is a comprehensive table of articles made from crucible steel, with figures indicating about the percentage of carbon each should contain. The book is intended for metal-working mechanics in general, and those interested in the subject.

Modern Machine Shop Tools, by W. H. Vandervoort, M.E. Publishers, Norman W. Henley & Company, New York. 1903. Price, $4.00.

This comprehensive work on modern machine tools, their construction, operation and manipulation, includes both hand and machine tools. It is beautifully illustrated with about 670 cuts and contains in all 600 pages. It is well printed on pages about 5½x9 inches.

The various hand and machine tools are grouped into classes, and the amount of space devoted to each is proportional to its relative importance. Each tool is considered with reference to its construction, its operation and maintenance, and the examples of work which can be done by it are given.

It is intended that the book shall be really a course of instruction to the apprentice and to the mechanic, a manual of practice, and for the foreman and the shop superintendent it contains many valuable suggestions and much useful information. The first chapter deals with the hammer and the cold chisel, the second with the file and filing, the third is on scrapers and surface plates, then follows the consideration of standards of measures. Chapter V is on calipers, VI is on gauges and indicators, VII rules, squares and other small tools. These are succeeded by chapters, one each, on Drills, Reamers, Screwthreads, Tap and Dies, Drill and Tapholders and Mandrels. Four chapters follow on the lathe, the lathe in modified forms, lathe tools, chucks and drivers for lathe work, the subsequent chapters are on lathe work, boring and turning mills and the various machine tools which are to be found in any up-to-date shop. The two last chapters, XXXIII and IV deal with miscellaneous shop equipment and conveniences, and with useful tables and data. The book also contains a good index for handy reference.

"Locomotives: Simple, Compound and Electric," by H. C. Reagan, Locomotive Engineer. Publishers, John Wiley & Sons, New York, 1903. Price, $2.50.

The popularity of this book is proved by the fact that it is now issued in its fourth edition and new matter has been added which is intended to put the reader in touch with the very latest and highest type of locomotive and with its details.

The work contains 565 pages of reading matter and is divided into fourteen chapters, followed by an appendix which is chiefly concerned with electric locomotives and apparatus. The illustrations, both half-tone and line cut, are good, and there are plenty of them. The printing, paper and binding are excellent.

One feature which is sure to strike a seeker after knowledge is that at the end of nearly every chapter there is a series of questions and answers pertaining to the subject of the chapter itself, and further, there are also questions and answers concerning breakdowns and the best methods of making temporary repairs on the road. The book has been written by a practical man for practical men, and this question and answer feature of the book is most valuable.

The locomotive boiler is first considered, then the front end; cylinders; frames, boxes and springs; rods and connections; the breaking of rods; valve motion; valve setting; the compound locomotive. This is a general description of the compound principle as applied to locomotives. Then follows a chapter on indicator cards; and one on the description of the various systems of compound locomotives. In this chapter all the styles of compounds used in this country are enumerated, and also the Webb system in Great Britain, and the various kinds of mishaps which may befall each particular kind of compound are taken up, and the best methods of dealing with each emergency are set forth. Injectors, safety valves and steam gauges, come next; then brakes, air-pumps, valves, governors and the Westinghouse brake; and then locomotive packings. The appendix which follows deals with electricity and electrical details, and a good reference index closes the book.

The aim of the author has been to instruct the reader in engineering, of whatever branch, to give him modern examples and a clear and thorough explanation of each point touched upon. This book is the real locomotive up-to-date.

Hollow Car Axles.

The success, as far as manufacturing goes, which has attended the making axles hollow by a process of punching, at the Homestead Works of the Carnegie Steel Company, has made the hollow car axle not merely a mechanical achievement of a high order, but has also made it a commercial possibility. It remains now for that impartial sifter of all work, Daily Service, under operating conditions, to report upon the performance of the hollow axle, and if that report is favorable then the hollow axle will be "in our midst," as country newspapers say.

The hollow axle for any given capacity of car will have to be somewhat larger in diameter than the solid axle for the same capacity, but it will contain less metal. A contemporary of ours remarks that if the steel in an axle for a 50-ton car is of the same strength both for solid and hollow axles, then the hollow axle will have to be ½ an inch larger at the journals than the solid one is now.

Some people are puzzled about the relative strength of a solid and a hollow column and often attribute some occult power to the empty space in the center of hollow pillars. It is needless to say that the empty space itself has no strength-giving quality. If a column had to be made out of exactly 1,000 pounds of metal the hollow form would be the stronger of the two, and the diameter of the hollow one would naturally be greater than the solid column of exactly the same weight.

Pursuing this line of reasoning a step farther it is obvious that if the two 1,000-pound columns are of unequal strength, the stronger, that is, the hollow one, when correctly designed, may have some metal removed from it in order to exactly equal the strength of the solid one. If metal is taken from the hollow one then it becomes lighter, while retaining strength equal to the solid one, and the saving of material has always a very satisfactory economic value. What has been said of columns applies to axles.

The hollow axle as now made at Homestead is said to save 33 per cent. of metal, and to have other advantages as well. The Homestead axle is, however, only hollow through journal and wheel-seat, and has a solid center. It has been made by a most highly skilful mechanical process devised by a scientific man of undoubted ability. We are, however, in this matter, only upon the threshold, but the door has been opened.

It may be that the hollow axle, with its weight-saving and its dense metal, made by what amounts to a flaw-detecting process, can be produced by rolling, and be hollow clear through, and still retain all the advantages which are now conceded to it. If so, the cost of manufacture may be still further reduced, and being entirely hollow, it would contain the minimum amount of metal with maximum strength. The seamless tube, if we may so say, used as an [illegible] a large internal oil reservoir, and the formation of wheel seat and journals might be accomplished without the necessity of lathe work, and without breaking or cutting into the skin of the dense smooth steel. The hollow car axle reveals great possibilities in the matter of cheap production, less liability to failure, absolute uniformity of production, greater service and less wear, and reduction of dead weight hauled with the paying load in every car. Such advantages have a very pleasing and dividend-paying aspect for railway men.

Tests to Find Out Power of Engines.

The Chicago & Alton people are making scientific tests with indicator and dynamometer car to find out the exact tractive power of their various types of locomotives. That is a very good thing to do, but it allows for variables which an actual test eliminates. Badly laid out curves, low joints, inferior track, mistakes in estimating gradients, and a variety of other uncertainties make it very difficult to ascertain by figures the hauling power of a locomotive, even when the figures are based on indicator diagrams. We are repeatedly informed by motive power officials that the ordinary rules for calculating tractions of locomotives are not found correct on various divisions. We believe that the rules are all right if the amount of resistance was what it ought to be according to the grades and curves. The resistance of curves is very hard to estimate under the most favorable conditions, and when the track is in bad order the best estimates are little better than guesses.

We think the Illinois Central people who are also experimenting to find out the tractive power of certain engines, have adopted the most practical methods. They load up an engine with trains calculated to be its load over a certain division, and if it hauls it easily they add cars until they find out its capacity over the various grades. This is not an absolutely perfect method, because the track may be badly out of order some time after the tests have been made, and then the engine will not be able to do the work which was performed by that making the tests; but on the whole, it is the fairest method that railroad companies could adopt. Tests of the capacity of locomotives by the use of the steam engine indicator are of doubtful utility. If the engine is not working properly the indicator is a good instrument to find out what is the matter, but it gives very little information about what trains the engine should haul on various grades. A mechanical engineer or expert on indicator practice can tell the mean effective pressure at the various points of cut-off of any ordinary

locomotive near enough for practical purposes without applying the indicator. If one engine is working different from others of a class then the indicator ought to be applied to ascertain the cause of the difference.

Carnegie's Gift to the Engineering Societies.

On February 14, 1903, Mr. Andrew Carnegie, addressing the American Society Civil Engineers, American Society Mechanical Engineers, American Institute Mining Engineers, American Institute Electrical Engineers, and The Engineers' Club, wrote: "It will give me great pleasure to give, say, one million dollars to erect a suitable union building for you as the same may be needed."

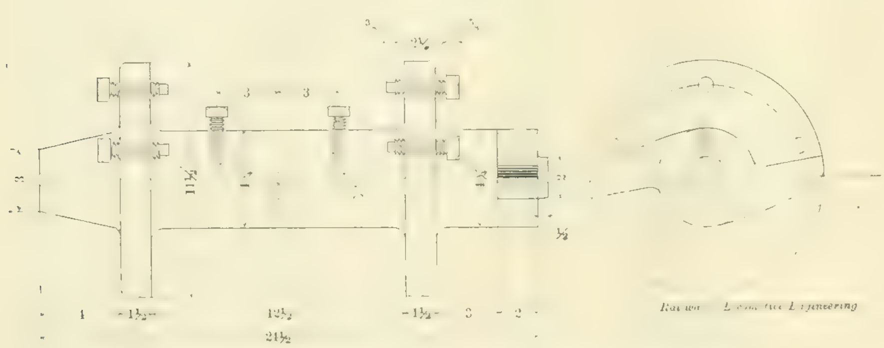
Was ever such a magnificent gift given in such a simple and modest fashion?

The societies which are beneficiaries of Mr. Carnegie's extraordinary gift, have been extremely in need of a common home, the useful work they are capable of performing having been restricted through inconvenient headquarters. The societies lost no time in taking the action necessary to utilize the gift. The American Society of Civil Engineers displayed decided reluctance to include themselves in a movement where less aristocratic people may realize benefit, but their opposition does not count for much. A joint committee representing the societies interested has been selected, which have already secured options on property in Thirty-ninth street, New York city, that will provide room for a magnificent building with sufficient vacant grounds to show off the place to the best advantage. The site is within three blocks of the New York city library, under construction, is within easy reach of the Grand Central station, and of the Pennsylvania station, that will be built soon, and is altogether an ideal location.

It is the intention to erect a hall suitable for meetings of the four societies, to form a combined library from the existing libraries belonging to the societies, and to provide accommodations for other engineering societies, such as the New York Railroad Club and others of a similar character. The conveniences and utilities provided will make the Carnegie Engineering Building the headquarters of all the engineering activities on this continent. It is a fitting tribute to the great work which the engineering world of America have performed and have yet to be achieved.

Handy Mandrel for Turning Driving Brasses.

A handy rig for turning up driving brasses has lately been put in operation in the shops of the Central Railroad of New Jersey, situated at Elizabethport, N. J. Our illustration shows a cast-iron mandrel for use in a lathe with lugs at one end for driving. There are two flanges cast on this mandrel, through each of which three set screws pass, and these bear against the edges of the brass. The two set screws in the body of the mandrel are adjusted so as to hold up the crown of the brass inside, and the two dowels are for the purpose of having the brass rest on them during the process of adjustment. A brass held in place on this mandrel can be quickly



HANDY MANDREL FOR TURNING DRIVING BRASSES

turned off and removed by the slackening of three set screws at one end. If the lathe hand has a number of the same kind of brasses to do, it is readily seen that time occupied in "setting" his work has been reduced considerably. The officials at Elizabethport speak very highly of the handiness of this appliance, and claim it to be a very good cost-reducing device.

Work Rushing in Baldwin's.

Baldwin Locomotive Works is turning out locomotives at an average of more than six every day in the week, not excepting Sundays. In April no less than 191 finished locomotives left the great Philadelphia plant. The average weight of the locomotives and tenders, including all types, was 125 tons. They represented a value approximately of $2,750,000.

Never before has the output reached those figures in any one month. In August of last year 167 locomotives were turned out, but that was not regarded as a normal output, as the preceding and succeeding months showed a much lower number. The total number of locomotives built at Baldwin's last year was 1,533. In 1901 the number was 1,375. For this year the output has been: January, 142; February, 132; March, 160, and April, 191—high-water mark.

There are more than 15,000 workmen on the payroll of the Baldwin Locomotive Works. The amount paid in wages is $190,000 weekly, or at the rate of nearly $10,000,000 a year. The materials used in construction cost considerably more. Orders in hand and others in prospect will, it is believed, continue the enormous business for months to come.

Additional Power for Baltimore & Ohio.

Since April 1 the Baltimore & Ohio has added 75 new engines to the motive power of the Pittsburgh Division. Of this number 65 were for freight use, while the remaining 10 are doing switching service in the yards. This makes the total number of engines on the Pittsburgh Division about 750, of which 450 are freight machines. The addition means 10 per cent. increase to the entire service, or 15 per cent. to the freight service. With the use of 13 miles of additional second track between Pittsburgh and Cumberland, which goes into service this week, the Baltimore & Ohio will be able to greatly increase the tonnage of the Pittsburgh district. The record of May promises to be 20 per cent. greater than that of April. Of the total tonnage the coal and coke shipments at present comprise more than 60 per cent.

New Engines for Buffalo.

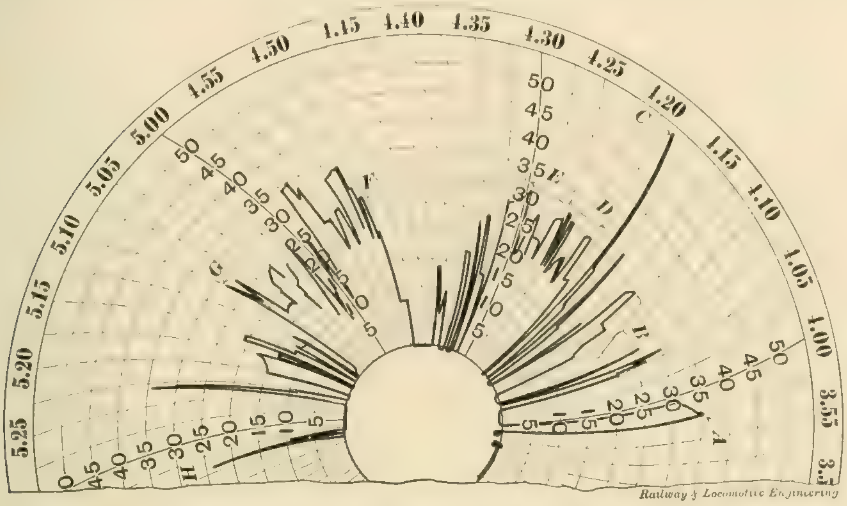
The Baldwin Locomotive Works is building two consolidation locomotives for the South Buffalo Railway Company. The locomotives will be equipped with Vanderbilt boilers, says the *Buffalo Express*. They are designed for heavy road service, and will be used exclusively for hauling freights over this short but hilly road. The line is seven miles long and runs from West Seneca to the tracks of of the Buffalo Creek Company, and has connections with the Buffalo, Rochester & Pittsburgh, the Lackawanna and the Lake Shore. The total weight of the locomotive is to be 175,000 pounds, with 159,000 pounds on the drivers, which gives 91 per cent. of the total weight for tractive adhesion. That is one of the features of the design. The heating surface will amount to 2,500 square feet, and the cylinders will take a pressure of 200 pounds. Recently, the same concern built a locomotive of the same type for the Buffalo, Rochester & Pittsburgh, but the new engine has 92 square feet of heating surface less than the other one, which is caused by shortening the tubes about 5½ inches.

Air-Brake Department.

CONDUCTED BY F. M. NELLIS.

An Interesting Brake Cylinder Chart.

This brake cylinder pressure chart was taken from Colorado Midland Passenger Car No. 107, on the Air-Brake Men's special train, Divide, Col., to Colorado Springs. The train consisted of three cars, handled by engine 201; engineer J. Kissell. Weight of engine on drivers, 91 tons. Total weight of engine and tender, 154 tons. Vauclain compound cylinder dimensions, 17x28x30 ins; driving wheels, 60 ins.; steam pressure 200 lbs. Engine equipped with Westinghouse combined automatic and straight air-brake, and the water brake with the Vauclain compression relief. Cars braked at 80 per cent. of light weight, based on 75 lbs. train-pipe pressure; 80 per cent. instead of 90 per cent. of the weight of the car is used, as the steady use of the retainers on a 4 per cent. grade may raise the brake cylinder pressure so high that at the slow speed which trains come down these grades wheel sliding may result.



AN INTERESTING BRAKE CYLINDER CHART.

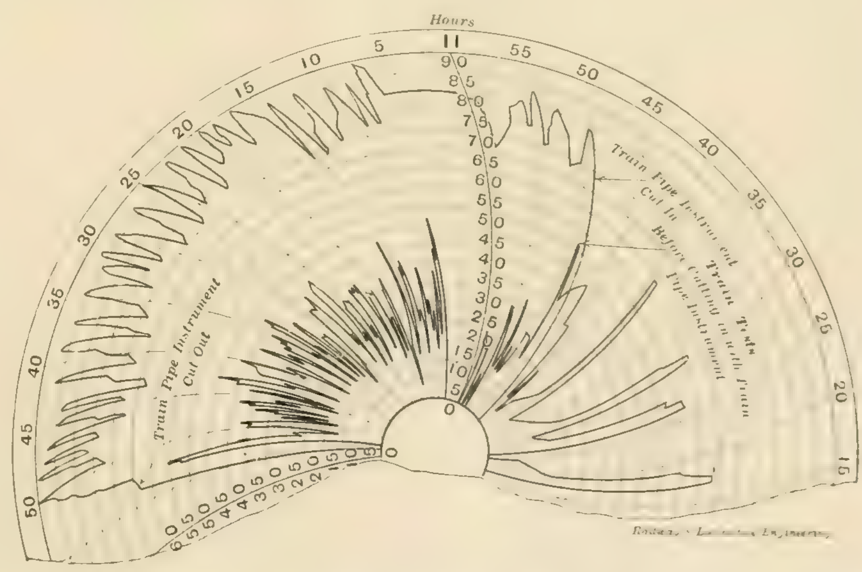
This train was handled by the automatic brake, the straight air or water brake not being used at any time. The recorder was adjusted to give a complete revolution in three hours. Connection was made from the brake cylinders to the recorder inside the car by means of a length of rubber tubing for convenient observation of the air-brake men.

The train left Divide at about 4.05 P. M., at the point marked A, test was made to determine if the recorder was in operative condition. At the point marked B it will be noted the brake was applied by making three reductions, before release, which is also shown in the next brake application. At the point marked C a full stop was made on account of being flagged. Between "D" and "E" retaining valves were in operation, the grade being 3 per cent. It will be noticed the retainer did not reduce brake cylinder pressure to 15 lbs., this was due to the reapplication of the brake being necessary. The cylinder pressure ranged between 20 and 30 lbs. for a period of about ten minutes on the 3 per cent. grade. Practically a uniform speed of 20 miles per hour was maintained.

Between "E" and "F" retaining valves were not used on account of lighter grade. Between "F" and "G" the train was on a 4 per cent. grade. Retainers were again used, the brake cylinder pressure in one instance reaching 35 lbs. The 3 per cent. grade was practically straight, while the 4 per cent. had a number of very sharp curves, one of them being as high as 16 degrees. For this reason the retained pressure in the brake cylinder was allowed to drop lower while rounding these curves. The reason for the retained pressure dropping below 15 lbs. was due to a slight leak in the connections to the recording gauge. From points "G" to "H" the retainers were turned down, the grade being considerably lighter, the train reaching Colorado Springs about 5.35 P. M.

Tenacious Work of the Air-Brake Convention.

The Air-Brake Association's motto is to improve the air-brake service on American railroads. It lives up to its motto in these conventions by working hard while it works, but can play equally hard while it plays. While the paramount intent of the association is to do work which will be forcibly felt and plainly seen by railroad companies, the air-brake men believe that there may be work as well as play at these conventions.



TRAIN PIPE AND BRAKE CYLINDER PRESSURE CHART TAKEN FROM COAL TRAIN DOWN JEROME PARK COAL BRANCH, COLORADO MIDLAND RY. FOUR PER CENT. GRADE. NO HAND BRAKES USED. 18 LOADED COAL CARS.

It is doubtful if any of the railway mechanical associations show as large an attendance as greeted the president at each of the meetings which he called to order in the morning at nine o'clock

in the convention hall. The first morning, the meeting consisting of the members and their ladies, was what would be expected in one of the larger mechanical associations. The second and third mornings' attendance was greater and considerably more than is had at the meetings of the larger associations. The third morning, nearly seven-eighths of all visiting delegates were in their seats at nine o'clock, when called to order by the president, and this, too, in the face of a carriage drive given by the association to the ladies of the convention to the Garden of the Gods, William's Cañon and Manitou.

This shows that the air-brake men can work even though there is entertainment going on coincidently. Truly the air-brake men are jealously guarding the welfare of their association by a refusal to permit themselves to be drawn from the convention hall to enticing pleasantries of outside entertainment. This is a feature that should be recognized by railroads sending delegates to the convention, and to those interested in the deliberations of this young but vigorous association.

To the Convention Bride and Groom.

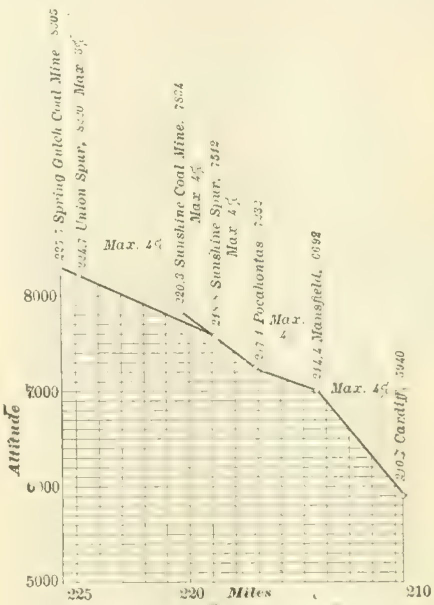
Here's to "Patsy," clever and bright,
Who "brakes" the road of Anthracite,
—Brakes it, too, without jar or shock
O'er hundred-pound rail and ballast rock.
With high-speed brake and Schedule U,
The slack adjuster and straight air, too,
He brakes all cars, whether loaded or light,
Up to date on the road of Anthracite.

And here's to her, "Miss Phoebe Snow,"
The convention bride of a week or so.
Whose ways are modest as the ripple's lap
On the mossy shores of the Water Gap,
Whose radiant look has the inspiring glow
Of the twinkling stars above Pocono.
May their life's journey be as smooth and bright
As a trip o'er the road of Anthracite.

The liberality of the railway officials of the Colorado Midland & Rio Grande, in issuing passes to members of the convention, is deserving of special note and comment. This exceptional generosity permitted members and their ladies to take in all the sights around Denver, Cripple Creek, Summit, Divide and Glenwood Springs, which some would have preferred to forego had they been obliged to pay fare. Too hearty thanks cannot be given to these thoughtful officials for their generous treatment of the Air-Brake Association.

The splendid entertainment arranged by the committee on arrangements was a prominent feature of the convention. A noticeable and commendable feature of this arrangement was that no entertainment was provided during convention hours, thus placing no enticement to draw members away from the meetings. This was a level-headed move, and in keeping with the substantiability of the committee.

The trip up Pike's Peak was an especially enjoyable one. The one and a half hour journey carried the tourists from a valley of sunshine and flowers into a weird land of rocks and ice above the clouds, where raged a violent snowstorm. Although the time was but four o'clock in the afternoon, the darkness indicated a twilight hour of seven or eight in the evening.



Profile, Jerome Park Coal Branch

ROUTE OF AIR-BRAKE ASSOCIATION'S TRAIN.

Five strenuous members of the convention arose one morning at five o'clock and took a fifteen-mile horse-back ride to Glen Eyre and through the Garden of the Gods before breakfast. Not one of the party had been in the saddle for ten years, and all rode like wild Indians and cowboys. So fatigued did that portion of their anatomy resting on the saddle become, and so unsatisfactory was the consequent search for a "well spot" to sit upon, that the whole party presented a grotesque appearance, hanging on sidewise and standing up in the stirrups, on the way home. These members absented themselves from the dining-room meals and stood up against the wall in the convention room. The unanimous verdict with them was "never again."

The rarified atmosphere at the summit of the Peak made breathing difficult, and several persons of the convention party were visably distressed. One ambitious member ran the short distance from the train to the shelter of the station and panted for ten minutes afterwards. At this altitude one must necessarily breathe about twice as much air to get the same amount of life-giving carbon into his lungs as at the seashore level.

Mr. S. J. Kidder's well-known railroad stories of quaint, droll persons, has earned for him the deserved name of "the Chauncey Depew of the Air-Brake Association." Depew's "Jed Prouty" gives way to Kidder's "Chris. Guyer," and the "Peekskill" of the Senator is replaced by "Galesburg, on the Q Rud," made famous by Kidder. Mr. Kidder would coin ducats if he could write stories as well as he tells them at conventions.

Some of the visiting members heard for the first time that beans and potatoes and such things cannot be boiled at high altitudes such as at Pike's Peak. This statement is true and apparent upon reflection. Water boils at lower degrees of temperature as we ascend into higher altitudes, and we find in altitudes of Pike's Peak height, that water boils at such low temperature that the heat of the water is insufficient to cook the vegetables through.

The consensus of opinion of the observing members was that the superior air-brake service of the western mountain roads is principally due to better condition of brakes. This better condition has been brought about by a better appreciation of the existing situation by western railway officers who have given air-brake maintenance their substantial support.

Tenth Annual Convention of the Air-Brake Association.

The tenth annual convention of the Air-Brake Association was called to order in Colorado Springs April 28 by Second Vice-President E. G. Desoe, President Goodman and First Vice-President Huntley being absent.

Addresses of Mayor and President.

Mayor Harris, in a few well-chosen words, welcomed the convention to Colorado Springs, assuring the members and their ladies of the city's sincerest hospitality and well wishes in the convention work. Mr. Desoe responded to the Mayor's welcome briefly, and proceeded to address the convention.

Mr. Desoe dwelt on the air-brake progress during the past year, making a special reference to the work which the association has been engaged in. He also urged the importance of the appointment of a high grade and thoroughly capable general air-brake inspector to take the whole charge of the air-brake

department of our modern railroads. He cited specific cases where such appointment had resulted in great benefit to the railroad through intelligent management of this important department.

Report of Secretary and Treasurer.

The secretary's report showed the association to be in a flourishing and prosperous condition, a number of members having been dropped from the roll because of non-payment of dues, etc. Eighty-six new members had been added during the past year, making a total enrollment of 700.

The treasurer's report showed the financial condition of the association to be sound and good, although the treasury balance this year was nearly $100 below that of last year, being $1,386.54.

The meeting hours for the convention were voted to be from 9 A. M. until 1 P. M. each day until the business of the association had been transacted.

Water in Train Pipes.

The first paper presented was that of the committee reporting on "Water in Train Pipes and How to Prevent Freezing." In the absence of Chairman Whitney, Mr. Desoe read the paper. Third Vice-President John Hume, Jr., taking the chair. The paper dwelt on the extended experiments made by the committee during the past year, and gave considerable additional data to the valuable amount which had already been secured. The committee urged the use of two main reservoirs and a length of discharge pipe from the pump to the main reservoir not less than 20 or 25 feet in length, and showed the importance of avoiding an excessive length of pipe which would cause freezing.

In the discussion which followed, Mr. Langan, of the Lackawanna, gave some interesting and valuable experience obtained during the past year in the line of this subject. He reported splendid results from limiting the speed of air pumps to not more than 140 single strokes per minute. If the pump could not supply the train in good condition with this number of strokes, it was removed from the engine and taken to the repair shop, being replaced by one in good order. If the leakage in the train line was too great to permit the keeping up of pressure with a good air pump at 140 single strokes per minute, repairs were made on the train pipe.

Other members believed that Mr. Langan's practice was exceedingly good. The entire convention approved of Mr. Langan's method of requiring the pump to be in good condition, and the train to be also in reasonably good condition to permit the pump to keep up pressure, instead of requiring a larger pump to keep up bad leakage, in which event leakage would naturally grow worse and more neglected.

Mr. Kelly suggested the use of long slender reservoirs where practicable instead of the short, stocky reservoirs commonly in use.

Mr. Nellis endorsed the committee's recommendation for a longer length of discharge pipe to the air pump as a preventative of water passing back into the train pipe. He cited a case on an eastern road which had trouble from water in train pipes, and which, after trying a length of 20-feet discharge pipe, the trouble entirely disappeared. He endorsed the use of long, slender reservoirs, where practicable, as such reservoirs afforded better opportunity for the heat to radiate from the air and deposit moisture into main reservoir, thus preventing it passing back into the train pipe.

Mr. Budig stated that after a winter's experience, he had succeeded in preventing water passing into the train pipe by the use of longer discharge pipe. It was his practice to blow out the train pipes at the end of each trip. Mr. Conger endorsed the practice of blowing out train pipes, and believed if it was followed out freezing of train pipes would be greatly reduced. He also endorsed the committee's views and recommendations.

Mr. Sitterly had experienced the value of long discharge pipes. He also endorsed the recommendation of long reservoirs where practicable, and also believed that further advantage may be obtained by the use of a larger discharge pipe, as large discharge pipes would serve in a small degree the purpose of long, slender main reservoirs.

Mr. Greenwade gave an interesting talk on main reservoirs and their connections. He believed that the association should recommend the use of at least two main reservoirs where practicable, and the connecting pipes should be of sufficient length to permit the water to be deposited in the main reservoirs from where it could be drained off. Mr. Kelly suggested that more frequent draining of main reservoirs would be had if a more convenient arrangement of drainage were supplied.

Mr. C. C. Farmer believed that all main reservoirs should be so arranged that a circulation of air could be had through them, and that no dead ends should be permitted.

Mr. Fredericks suggested that the pipe entering the main reservoir should never be placed opposite the point where the pipe led out of the main reservoir, as this gave too direct a current of air through the main reservoir, which permitted warm air to flow through the reservoir into the brake valves. He cited a case where the changing of pipe of this nature had resulted in greater deposit of water in the main reservoir and less in the train pipe.

Mr. F. B. Farmer deprecated the practice of having the suction of the air pump so arranged that steam and vapor from leaking piston rods, valve stems, injector, overflow pipe, etc., could be sucked into the air pump, as many pumps are not yet supplied with the longer discharge pipe. This moisture would be carried back into the train pipe more easily than if dry air were taken in.

Mr. Alexander stated that the Pennsylvania had for some time past installed two main reservoirs to each engine and that now a discharge pipe of about 20 feet connected the air pump and the first main reservoir, and a connecting pipe between the two main reservoirs had a length also of about 20 feet. He stated that with such arrangement his line had experienced no trouble whatever on engines so equipped from water accumulating in the train pipe. He also stated that his road had been applying small pet cocks in the main reservoir instead of the old tap plug to draw out the drainage. This arrangement was vastly superior to the old plug, as the engineer was accustomed to open this cock frequently in passing around his engine, where he would not take the trouble to carry down a monkey wrench and remove the plug. He believed this a great improvement, as the reservoir could be drained without drawing off all the pressure.

Mr. F. B. Farmer related his experience with engines in the extreme Northwest which was in line with that of the committee, and he endorsed their recommendations. He did not believe that the association could adopt a standard length of pump discharge pipe for all engines in all climates, as the tendency for the discharge pipe to freeze up before entering the main reservoir increased after a certain length of pipe was reached. He believed that from about 20 to 30 feet gave good service under average conditions.

Mr. Alex. Brown also endorsed the committee's recommendations and stated that in the Eastern Canadian country that little trouble had been experienced with freezing of the train pipe where reasonable length of pump discharge pipe had been employed. He cited an instance where an air-brake man had suggested use of the hand rail for delivery pipe, in cases where the location of the pump discharge pipe was inconvenient. One member objected to this arrangement, as he believed one pipe should not be required to perform too many functions, especially in this case where the discharge pipe would be hot and would be disagreeable to the touch of engineer or fireman, should they be required to pass along the running board and hold to the pipe while the train was moving.

Trip up Pike's Peak.

The meeting adjourned at 12 o'clock to prepare for a trip to Pike's Peak,

which had been arranged by the entertainment committee. The members and their ladies left the base of Pike's Peak for the summit at 2 o'clock. One train had been prepared, but as the number was larger than had been anticipated, two trains were provided. Both these trains proceeded to the summit, where the members and their ladies found themselves in a heavy snowstorm, being unable to see more than a few feet away. After an hour's sojourn at the Peak, the party returned shivering to the cars to descend the mountain. Several of the ladies and gentlemen were considerably inconvenienced at the high altitude of 14,000 feet, two of the ladies and one of the gentlemen being in a somewhat alarming condition when leaving the summit, although they quickly recovered as the descent was made. Down at the timber line (11,000 feet), the party passed through the clouds and out of the snowstorm, all parties again feeling in jubilant spirits and in comfortable condition.

The evening was spent by the members and their ladies in the parlors and lobby of the hotel getting better acquainted. All retired early in order to begin the next morning's session on time.

Wednesday's Session.

The convention was called to order on Wednesday, the second day, by Chairman Desoe, and discussion of the paper on "Frozen Train Pipes" was resumed, several members taking part. After a general discussion, the subject was closed, the paper accepted and the committee discharged.

High-Speed Brakes.

The next paper presented was that on "High-Speed Brakes." In the absence of Chairman Roney, Mr. Carlton read the paper. The paper stated that during the past year nothing of material importance had been reported to the committee or had been added to the information already at hand. Several members reported that their lines had adopted the use of the high-speed brake on all of their passenger trains, both through and local, and with entirely good results, quite up to those expected, had been secured.

Mr. Kelly stated that during the past winter some tests had been made without the automatic reducing valve, but with higher train-pipe pressure than the ordinary brake, which stopped the train in a little shorter distance than in competing test made with high-speed brake. He added that the automatic reducing valve feature now employed was perhaps the best that could be obtained at the time of its invention and was doubtless giving very good results; that during the coming year further tests along the lines he had experienced would produce interesting and valuable information in high-speed brakes.

Mr. Garrabrant, of the Pennsylvania road, stated that his line had adopted the high-speed brake on all its passenger trains, both through and local, and that they expected improved results. No flat wheels had resulted since his line began this total installation with high-speed brakes. He was loud in his praises of the high-speed brake.

Mr. Carlton, of the Chicago & Northwestern, stated that the high-speed brake had been in service on all of their through trains for some time past. It had given entire satisfaction and very much improved results.

In reply to a question from Mr. Conger, Mr. Carlton stated that the ordinary standard hose had proved sufficient for high speed brake trains, carrying a pressure of 110 pounds. He had not observed that high speed brake trains were any different in any sense, so far as hose were concerned, from trains carrying a 70-pound train line pressure.

Mr. Budig, of the Burlington, stated that the shoe wear on his road was greater with high speed brakes, due to performance of more highly efficient brakes, than experienced with the 70-pound brake. Mr. Carton's experience was coincident with that of Mr. Budig.

Mr. Kelly believed that an air brake, based on lower train pipe pressure might give better satisfaction than one obliged to carry 110 pounds pressure, as the heat generated at such high pressure reduced the holding power of the shoe—shoe wear was also more excessive with high speed brakes.

Mr. Nellis questioned the wisdom of such a change, believing that the increased advantage of high speed brake service warranted faster shoe wear, stronger foundation brake gear, etc. He stated that a foundation brake gear meeting the M. C. B. requirements was amply strong for high speed brake service.

Mr. Langan expressed the belief that in changing the foundation brake gear on cars having light rods, flexible brake beams, etc., should be supplied with liberal cylinder capacity in the event of a form of high speed brake, depending on lower train line pressure than at present employed with the high speed brake, should be developed and adopted.

Mr. Culver objected to an unreasonably large cylinder, the total leverage, in his mind, being about 8 or 10 to 1. He reported the cars on the New York Central road as being sufficiently strong with the old brake up to the M. C. B. requirements, and that no change was therefore necessary in any of the foundation gear in going from 70 pound brakes to high speed brakes.

A number expressed the belief that both the low pressure and high pressure reducing valves should be tagged in order that they might be more readily recognized by the engineer, who might possibly get bewildered and turn the reversing cock the wrong way.

Mr. Budig reported excellent results from transferring the reducing valves and reversing cock from the old position outside and under the running board to a place inside the cab where the warmth would prevent the parts from freezing.

Mr. Libby, of the Lake Shore, stated that the practice of his road to paint the high pressure reducing valve and small cut out cock a red color in order that they might be more easily recognized and more easily manipulated by the engineer. The plan, he said, had proved a good one.

Mr. Desoe believed that the matter of brake shoes should cut no figure in deciding between the 70 pound brake and high speed brake, and also believed that the Master Car Builders would require a brake shoe for high speed brake service if a different brake shoe were needed than is now used in ordinary service. He believed that the matter of brake shoes should not retard or check the use of high speed brakes on roads, either in fast passenger or local service.

Mr. Culver believed that more than 10 pounds excess should be carried with the high speed brake on trains hauling more than 4 cars. He stated that on the Empire State Express on the New York Central, no trouble from slid flat wheels had been experienced, but that on the 20th Century Limited, where the train is composed of 6 cars, slid flat wheels had been experienced. This he supposed was due more to lack of excess pressure than it was to the high train line pressure carried. Mr. Desoe agreed with Mr. Culver that at least 20 pounds excess should be carried with high speed brake.

Mr. Kidder advised that no hard and fast rule could be made with regard to amount of excess pressure carried, but that each road, having its own local and peculiar conditions, should adopt the excess required. He stated that 10 pounds excess originally adopted by the Westinghouse Air-Brake Co. had resulted from the experience then at hand, which was confined to trains of 3 and 4 cars in length.

Mr. Conger endorsed the resolution making it the sense of the meeting that 20 pounds excess should be carried where needed in high speed brake service, the same as at present carried with the 70 pound brake.

Mr. Fredericks stated that some few slid flat wheels had resulted on his line with high speed brakes, but that cleaning the triple valves had resulted in disappearance of the trouble. Both he and Mr. Alexander spoke highly of the change from 10 in.x12 in. to the 10 in.x14½ in. equalizing reservoir, as the change had resulted in a discontinuance of the trouble of brakes going into

emergency when service application was made on the shorter trains.

Mr. Kidder advised that the 10 in.x14½ in. equalizing reservoir was now the standard of the Westinghouse Air-Brake Co.

Mr. Jones advised that his past year's experience with high speed brake had been of an entirely satisfactory and pleasant nature. He strongly endorsed the views of the committee.

Upon vote the paper was accepted, the committee thanked for its work and discharged.

Topical Discussion.

It now being 12 o'clock, subjects for topical discussion were taken up, and Mr. Carlton opened the subject by calling for the experience of other members in matter of testing the efficiency of the air pump cylinder. The discussion was carried on at considerable length, and two good methods were endorsed.

Mr. C. C. Farmer mentioned a test practiced on some roads and known as the "oil cup test." This consists of opening the oil cup on the top of the air cylinder, and noting whether air pressure escaped past the packing rings. On the down stroke, at about 25 strokes per minute, the packing rings, if in leaky condition, would show up by pressure passing from the lower side around the rings into the upper side of the piston and out through the oil cup. On the up stroke the tightness of the rings could be determined by the amount of pressure escaping at the oil cup. This test, he believes, was valuable as a quick and easy test under ordinary conditions.

Mr. Parker, of the Great Northern road, recommended a test which consisted in the attachment of a pressure gage in the lower head of the air cylinder. On the up stroke at about ¾ of the distance traversed, at about 30 strokes per minute, the gage would show about 7 or 8 pounds with the pump in ordinary good condition. The pump in bad condition would show a great deal more. Mr. Parker advised that pumps which had just been overhauled would sometimes show a gage pressure of this amount. The discussion on these two tests brought out a great deal of valuable and useful information to the convention.

Trip to Summit.

The convention adjourned at 12:30 to prepare for a trip via the Colorado Midland Railroad to the Summit. A train consisting of engine and 3 cars carried the convention party above the clouds, and into another snow storm. The wonderful engineering feat of building a railroad line along the abrupt cliffs and boring through rock tunnels was impressed upon the members and commented upon by them. On the descent several of the convention men attached a recording gauge to the train pipe of rear car, from which was taken readings of the manipulation of the brakes by the engineer. The descent was made from the 10,000 foot level, down through the clouds and the snow storm to the sunshine in the valley below without any considerable excitement, the party landing at the Alarm Hotel about six o'clock.

The Hotel Hop.

At 9 o'clock the members and their ladies proceeded to the ballroom of the hotel, where the manager had prepared a dance for them. Everyone seemed to join in and more than 100 couples tripped the light fantastic till 12 o'clock to the excellent music of the orchestra of 12 instruments provided by the hotel management in honor of the occasion.

Thursday's Session.

Thursday morning the discussion of efficiency of air pump cylinders was continued, but shortly closed by unanimous vote.

Combined Automatic and Straight Air Brake.

The topical discussion presented by Mr. F. B. Farmer on combined automatic and straight air brake was presented. The paper was full and complete, and showed careful preparation, containing valuable experiments and their data. Mr. Farmer advised that a large number of straight air brakes were in operation on roads in the Northwest where they were giving excellent satisfaction in switching service, long train service, and mountain service. He advised that much benefit had been derived from this device in long train service on level roads where break-in-twos had been experienced. He also advised that it was in successful operation on mountain grades where straight air could be held on locomotive and tender while the automatic brakes were being recharged on the train. For switching, and in "spotting" the device had been exceedingly advantageous and acceptable.

Mr. Strickland advised that the device had been in exceedingly satisfactory operation on his road, where accurate "spotting" of cars was required. He said that several minor changes had been made in the double check valve and reducing valve which rendered it more adaptable to the peculiar service of his line.

Mr. Nellis reported that one of the large anthracite systems in the East had adopted the device on all of its heavy freight engines after a service trial of 2 months on one of its heavy engines. On this road trouble was experienced in the heavy grades from skidding of wheels, due to "clubbing" of the brakes by the brakeman. The device had proved that trains could be dropped down heavy grades with this device and "clubbing" rendered unnecessary. On long coal trains, on level portions of the road, the device had proven an excellent assistant in taking up slack of train in applying brakes and holding in the slack in releasing brakes, thus preventing damage to draft gear and break-in-twos.

Mr. Kelly reported that the straight air brake manufactured by the New York Air Brake Co. had given excellent satisfaction in hill service.

Mr. Hutchins advised that the device had entirely eliminated the difficulty experienced on a very heavy grade of the Louisville & Nashville road, where hand brakes had been necessary to assist the air brakes in controlling the speed of trains down a heavy grade.

Mr. Parker reported excellent results from the use of the combined automatic and straight air brakes on his line.

Both Mr. Carlton, of the Chicago & Northwestern, and Mr. Libbey, of the Lake Shore, reported equally good results from the use of this device on their lines.

After further discussion on this subject, it was closed and the convention proceeded to election of officers which resulted as follows:

Election of Officers.

President, E. G. Desoe, Boston & Albany; first vice-president, John Hume, Jr., Houston & Texas Central; second vice-president, L. M. Carlton, Chicago & Northwestern; third vice-president, W. P. Garrabrant, Pennsylvania. Executive committee, J. H. Hardy, Colorado Midland; P. J. Langan, Delaware & Lackawanna; C. P. Clendennin, Colorado Midland. Secretary, F. N. Nellis, New York; assistant secretary, F. W. Gross, New York; treasurer, Otto Best, Nashville, Chattanooga & St. Louis.

Buffalo Selected.

Buffalo was selected as the next meeting place, the convention to convene the second Tuesday in April, 1904.

Convention adjourned.

Trip to Divide.

A trip for the members and their ladies to the Continental Divide had been arranged by the Colorado Midland, which furnished a locomotive and three cars for the occasion. The 3 coaches were well filled, and the party enjoyed immensely the trip over the winding road, through the tunnels and canyons to the summit of the mountain. Here all passengers disembarked and gathered wild flowers.

After the attachment at recording gages to the brake cylinder of the first car and the train line of the third car respectively, the train started to descend the mountain. In the evening the members began to scatter to their various homes, quite a considerable number remaining to take side trips to Cripple Creek, Glenwood Springs and Salt Lake City, transportation having been kindly

provided by the Colorado Midland and the Denver & Rio Grande roads.

Thus ended one of the most successful and best attended conventions of the Air Brake Association.

Handling the New York Engineers' Brake Valve.

In the May number we illustrated the 1902 model New York Engineers' brake valve, and called attention to the modifications and improvements incorporated in it.

While it is well to understand clearly the principal features in the construction of a piece of mechanism, it is also equally, if not more, important that we give attention to the proper method of handling it in order to get the best results.

At the outset, it should be borne in mind that the function of the brake valve in air-brake operation is to regulate the flow of air into and out of the train pipe, in order to charge the air-brake apparatus, and to enable the engineer to apply the brakes in the manner and with the degree of force desired, and to release them properly.

As shown in Fig. 5, May number, the handle is in release position, and the main slide valve 114A is in the extreme forward position, uncovering a large portion of port *A* (shown in Fig. 1) in its seat. As may be easily seen, the main reservoir air can flow freely into the train pipe, so long as the handle remains in this position.

When charging up the train pipe and auxiliary reservoir, it is desirable that it be done quickly, and hence while charging up the air-brake apparatus, the handle should be left in release position.

When the train pipe is charged almost to the required pressure, move the handle to running position, shown in Fig. 6 (May number). This is the position in which it should be carried ordinarily, after the train is charged, brakes released and the train standing or running.

It will be observed that in running position slide valve 114A is moved back a short distance from the extreme forward position-release, and that port *E*, in its seat, comes directly under cavity *M* in its face. Port *E* is shown in Fig. 1, and cavity *M* is shown in Fig 2.

With port *E* and cavity *M* in communication, main reservoir air flows into the train pipe by way of the passage leading to the excess pressure valve 97, as explained in the May number, and shown in Fig. 4.

As the excess pressure spring has a tension, sufficient to resist a pressure of twenty pounds per square inch, tending to force it upward from its seat, the air from the main reservoir, flowing to the excess pressure valve, must overcome this resistance before the valve can rise from its seat, and any of the air pass it; therefore, it follows that the main reservoir pressure must be twenty pounds greater than the train-pipe pressure before any air can pass from the main reservoir into the train pipe with the handle in running position.

Excess pressure carried in the main reservoir is necessary to insure a prompt and a certain release of all the brakes, and to recharge the auxiliary reservoirs quickly.

Therefore, after the train pipe and the auxiliary reservoirs are properly charged, the handle should be moved to running position, where the pump will pump up the "excess," and the ordinary train pipe and auxiliary leakage will be supplied through the excess-pressure valve. About the only exception to this rule is when recharging auxiliaries on down grades—a case where it is important that auxiliaries be recharged as quickly as possible.

The lap position, shown in Fig 7 (May 26), is used to prevent the flow of air through the valve in any direction, and it is used in service application of the brake whenever the automatic cut-off feature is inoperative, to close the train pipe exhaust; when a hose bursts, the train parts, or the conductor applies the brake from the rear. In all these cases the handle of the valve should be moved to lap position to hold the brakes on or to prevent the loss of main reservoir air, as the case may demand.

While we say the handle should be placed on lap, when a hose bursts, etc., to save main reservoir air, a little thought will show that the service or the emergency application position will answer the purpose equally well, because communication between the main reservoir and the train pipe is cut off in all positions of the handle, except release and running.

The service application position is subdivided into five graduated positions, and when the handle is moved to the first of these positions, a gradual reduction of five pounds will be made in the train pipe pressure, and the valve will automatically cut off further escape of air from the train pipe in that position. To reduce train pipe pressure further, it will be necessary to move the handle to the next graduated service notch, and after the additional reduction is had in train pipe pressure, corresponding to that notch, it will lap itself, and so on down to the last service graduating notch, when it will be found that a total reduction of twenty-three pounds in train pipe pressure will be had. This is the amount of reduction required to set the brakes in full in a service application from a train pipe pressure of seventy pounds, and at the same time provide for slight variation in piston travel.

In Figs. 8 and 9 the operation of the valve in service application is illustrated, so that not much explanation is needed. Fig. 8 shows the handle in the third service graduating notch, and the arrows indicate the way which the air takes to escape from the train pipe to the atmosphere.

Fig. 9 shows the automatic cut-off position of the valve, valve 110 blanking port *F*, in the face of the main slide valve, and preventing further escape of air from the train pipe.

It should be remembered then when making a service application that the handle of the brake valve should be placed in the service graduating notch, that will give the desired reduction in train pipe pressure, and left there until an additional reduction is desired, or the handle is moved to release position to let off the brakes.

When making a service application, should the train consist of three cars or less, the handle should be placed in the first graduating notch, as port *F* in the face of slide valve 114A, in this notch, is only about half open, and, therefore, the escape of air is restricted to a rate that will obviate the danger of setting the brakes in quick action. With trains of ten cars or more the second graduating notch should be used for the initial train pipe reduction, as it usually requires a greater than five-pound initial reduction in train pipe pressure to move the brake cylinder pistons on trains of this and greater length, beyond the leakage grooves, and also to get a more prompt movement of all the triple valves.

Should it occur in service applications that the automatic cut-off feature fails to work, then when the desired train pipe pressure reduction is had, move the handle of the brake valve back toward positive lap position until the train pipe exhaust ceases. When necessary to move the handle in this way, if the train consists of forty or more cars, move it slowly, so that there may be no abrupt closing of the train pipe and consequent surge of air in the front end of it that might cause the driver and tender brakes to release.

When emergencies arise there is but one thing to do with the train pipe air—let it escape as quickly as possible.

To do this, place the handle in the emergency position as shown in Fig. 10, and leave it there until the train stops or the danger is passed.

When releasing brakes, it is good practice to hold the handle of the brake valve in release position momentarily, the length of time that it should be held there depending somewhat upon the number of air-brake cars coupled and working, to insure the release of all brakes; then it should be moved to running position.

This rule for moving the handle to running position after releasing brakes

holds admirably in all cases where the main reservoir pressure does not fall below seventy pounds, and equalize with the train pipe pressure; when the main reservoir and the train pipe pressures equalize below the standard train pipe pressure carried, after the handle is moved to release position to release the brakes, then it should be allowed to remain in that position until both hands on the air gauge, moving up together, nearly indicate the standard train pipe pressure, then the handle may be moved to the running position. Handling the valve in this way prevents the pump from stopping when standard train pipe pressure has been obtained, and it will continue to work on until standard main reservoir pressure has been obtained.

To sum up the matter of handling the New York Engineers' Brake Valve, whenever it is required to charge the train pipe and auxiliaries quickly, as after coupling on to an empty train pipe at the terminals, or to recharge auxiliaries quickly while descending grades, place the handle in release position and let it remain there until the full train pipe pressure has been nearly obtained; then move the handle to running position, so that the excess pressure may be obtained in the main reservoir.

Positive lap position blanks all ports, and the handle should be placed in this position when circumstances such as mentioned above, pertaining to use of lap position, require that it should be.

The service graduating notches should be used in making service applications; and in emergencies, always use the emergency position, leaving the handle there until all danger is passed.

(Continued in next number.)

QUESTIONS AND ANSWERS

On the Air-Brake.

(43) E. J. L., Wellington, New Zealand, writes:

A driver coming into a station with about 30 wagons makes a 7- or 8-pound reduction, but before the after blow has finished, he gets a right-of-way signal and puts brake handle into full release, when the jar he gets nearly sends him through the window. What is the cause? A.—The answer given to W. J. H. in question 47 is the answer to this question also.

(44) R. G. P., St. Paul, Minn., asks:

In the event of double-heading passenger trains, is it customary to cut out air signal on second engine, and what is the practice usually followed? A.—On some roads the practice is followed of cutting out the whistle-signal apparatus on the second engine in a double-headed train. On other roads both engines are left cut in. The difference is not very great, as the whistle operates about as well with both engines as if the second engine were cut out.

(45) J. H., Phillipsburg, N. J., writes:

We have three 8-inch air pumps that have been overhauled, new reverse valves put in, also new bush, new reverse piston and bush, new main steam valves and bushings, and new rings in pistons. They all make an up stroke, come down and stop. What is the matter? A.—Your trouble is probably due to either the failure to properly get steam pressure through port in upper head gasket, past reversing valve bush onto top of your reversing piston to operate the valve motion, a worn reversing plate, too long reversing-valve rod or the piston striking some of its parts against the bottom head in the air cylinder.

(46) R. M. E., Wellington, New Zealand, writes:

A driver while standing at the station with a tidy long train, makes a 7-pound reduction which sets the brakes. He then makes a 2-pound reduction, when the first three brakes come off. What is the cause? A.—The equalizing piston may be working stiffly, due to lack of lubricant or presence of foreign matter, thus closing abruptly the train pipe before the pressure in the train pipe has equalized, thus kicking off the head brakes. If the train is a short one, the same trouble might be produced by a leakage of main reservoir pressure through a faulty rotary valve or bad gasket into train pipe, thus forcing the triple valves on head cars to release position.

(47) W. J. H., Wellington, New Zealand, writes:

A driver coming into station with long train makes a 7 and 3-pound reduction and finds he has stopped too short. He puts handle into release position when he shortly receives a nasty jar. What is the cause? A.—This is due to the release of brakes on head end of train while those on rear end remain set. If the brake-valve handle is placed in release position, admitting main reservoir pressure to the train line, while the exhaust is still blowing at the brake valve, we will have a strange combination of reduction of pressure in the rear part of train pipe and increase pressure in head end; or, in other words, brakes will be still applying on the rear end while they are releasing on the head end. This condition will cause the slack of the train to run out, giving the jar referred to, and generally causing a break-in-two if the train be a long one.

(48) A. J. B., Columbus, O., asks:

Should air-brake hose be any stronger or thicker where the high-speed brake is used? A.—It was at one time believed that stronger hose than the standard form should be used for high-speed brake service. Several years ago, when the New York Central equipped its Empire State Express with high-speed brakes, it applied to one of the prominent rubber concerns for a stronger hose, believing that 110 pounds train line pressure would require a stronger hose than would a 70-pound brake. The rubber company somewhat reluctantly consented to make a 5-ply hose for this high-speed service. At the end of the year the hose was removed regardless of its condition and placed in ordinary service, new 5-ply hose taking its place. After four or five years' experience it was decided to abandon the 5-ply hose, as it seemed to give no advantage over the 4-ply, and it was believed the latter was sufficiently adequate for high-speed service. There is, therefore, but one class of hose for the service of both high-speed and ordinary forms of brakes.

(49) W. J. H., Wellington, New Zealand, writes:

A driver, after releasing brakes, lets his train charge up to 70 pounds, and then puts his handle smartly into running position, when the first three or four brakes will go on, but if he puts his handle slowly in the running position they stay off. What is the cause? A.—No mention is made whether the brake valve is of the type with the common excess pressure valve or with the improved feed-valve attachment. If the former valve is used, the trouble is probably due to leakage in the train pipe. The pressure pumped up in the main reservoir after the handle has been moved to running position must give 20 pounds more there than is in the train pipe before any feed is had from the main reservoir into the train pipe. While this 20 pounds excess is being pumped, the brakes may creep on if there is train pipe leakage. The fast or slow movement of the handle from full release would have no effect on this, except perhaps that during a slow movement, the pressure passing back through full release position would have better opportunity to equalize in a train of any considerable length. This may be the cause of the trouble. On the other hand, if the brake valve is of the type having a slide-valve feed valve attachment, the trouble is probably due to the higher pressure in the train pipe while the valve is in full release position, than the feed-valve attachment is set for. In this case leaks in the train pipe would have to lower the train pipe pressure sufficiently to permit the feed-valve attachment to open and give a feed from the main reservoir into the train line.

Note: Most of our general matter has been crowded out this month by Air Brake Association convention matter, but will appear in next month's issue.

Don't fail to get your regular copy of the Air-Brake Association proceedings of the Colorado Springs convention.

Southern Railway Improvements.

The work of double-tracking the Washington division of the Southern Railway between Alexandria and Orange, begun early in the spring, is being pushed forward as rapidly as possible, and those in charge of the work state it will be completed by September 30. In putting down the second track, the curves have been abolished as much as possible, and it is the purpose of the railroad company to make the old track conform to the new road as soon as the latter line is finished.

Plans are now in preparation in the office of the chief engineer to double-track the road from Orange through to Atlanta. All plans will be finished this year, and the appropriation for the work made by the board of finance at its winter meeting. Much money has been spent this year for the purchase of locomotives and rolling stock. An average of five engines are delivered each week to the road, and as soon as they are received they are broken into service.

The company are preparing to improve a large mileage of the road by putting stone ballast under the track. The Sinclair Construction Company, of Chicago, are erecting a large stone crusher in North Carolina, and it is expected that several other plants will be installed in the near future.

The Delaware, Lackawanna & Western does a large share of the business of hauling suburbanites out of New York to the breezy uplands of New Jersey. The railroad takes the passengers at Hoboken from the Ferry Company, which has given rather an indifferent service. The railroad company have now purchased all the franchises and property belonging to the ferry company, and the multitude of people who have to cross the Hudson River at that point are anticipating considerable saving of time on account of the change.

A Lecture on Mechanics.

Not long ago, Mr. Roger Atkinson, master mechanic of the Reading shops of the Philadelphia & Reading Railroad, delivered a very interesting address to the employees of the company on the science of mechanics. The lecture was delivered under the auspices of the Railroad Y. M. C. A., and was so well received that it is probable Mr. Atkinson will be asked to deliver another.

After some preliminary remarks, and after defining the terms "matter" and "force," the lecturer proceeded to explain the method of measuring force; to do this it is necessary to get a standard which is easily comprehended, and easily duplicated, we therefore select one of the forms of force which exist in nature—the attraction of gravitation. We use "gravity" in the form commonly called "weight" for many purposes to measure force. As every particle of matter attracts every other particle of matter in the universe, it follows that the apple which Sir Isaac Newton observed, as it fell to the earth, caused the earth to "fall up" to meet it, but the amount of movement being inversely proportional to the weight of the body, the earth's motion would be imperceptible.

This was illustrated graphically by an oval containing five points and another oval containing three points. If lines be drawn from the five-particle body marked A, to the three-particle body marked B, so that lines from each of A's particles reached each of B's particles, we would have 15 lines of mutual attraction between the two bodies. As B consists of only three particles, it is obvious that the 15 lines of attraction will have more effect upon B than

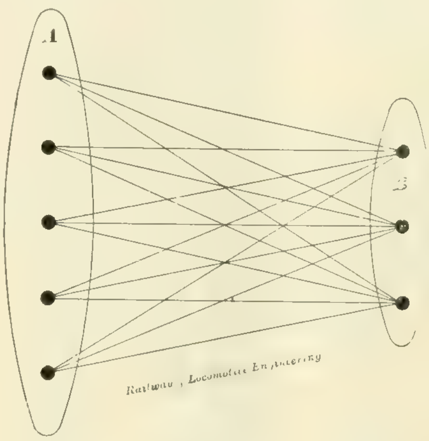


DIAGRAM ILLUSTRATING ATTRACTION.

upon the 5 particles of A. Therefore B will move toward A, more than A will move toward B.

Our standard weight of one pound only balances one pound of attractive force at the sea level and at a given latitude or distance from the equator. It does not weigh the same in a mine, or the same on a mountain top, nor at the equator nor at the poles. A body weighing one pound at the sea level at the latitude of Greenwich when hung on a spring balance, produces a certain extension of that spring which may be noted. At the pole it would pull harder and extend the spring further; with less spring extension at the equator or on the top of a high mountain, according as it approaches or recedes from the center of gravity of the earth. The speaker very clearly differentiated "mass" from weight by showing that if one pound weight were transported to the actual center of gravity of the earth, the particles of the earth pulling it in every direction would simply neutralize each other, and the "pound" would weigh nothing, though its mass would remain unchanged.

The pound weight, this measure of the force of gravity is a purely arbitrary standard adopted for convenience. A piece of platinum which "weighs" exactly one pound at Greenwich is deposited in the office of the Exchequer for reference in England. (A similar reference standard is kept at Washington.) In the metric system the unit of weight is one gramme, and this also is a purely arbitrary unit, in the same way that the pound is.

Powerful Electric Locomotives.

The electric motors which the Baltimore & Ohio put in service several years ago for hauling trains through the Baltimore tunnel proved too weak for the service and the company are replacing them with electric locomotives designed to give much more efficient service. These motors are the heaviest ever built, and with the three 96-ton motors now in use will enable the company to haul all the freight and passenger trains from Camden Station to the top of the grade without the steam locomotive rendering any assistance.

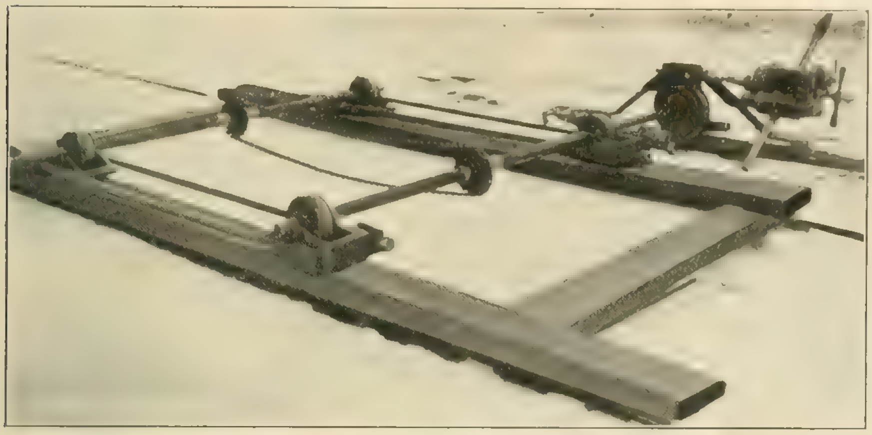
The new electric locomotive is made up of two independent duplicate sections coupled together, each section being equipped with four 65 horse power motors, so arranged that either section can be operated independently, or from any one section two or more sections can be controlled. The capacity of the locomotive can at any time be increased by adding duplicate sections as desired. Two sections of the locomotive, weighing together 150 tons, are designed to handle a loaded train weighing, complete with steam locomotive, but exclusive of electric locomotive, 1,500 tons, over the Belt Line grade from Camden Station through the tunnel to the summit, a distance of 3.44 miles, at approximately a maximum speed of 10 miles per hour on the .8 per cent. grade and 9 miles per hour on the 1½ per cent. grade when operating at 625 volts.

A neat little booklet called "Points on Packing," has just been issued by Jenkins Brothers, whose New York office is at 71 John street. Information concerning the Jenkins '96 packing is given. Its strength, flexibility, durability and its ability to become vulcanized are duly set forth. The firm supply gaskets of any size and in any quantity on short notice. They also make gasket tubing, union rings, water-cock washers, discs and pump valves. Write Jenkins Brothers for the "Points," and the little book will be sent free.

The Richmond Locomotive Works officials are fighting the granting of saloon licenses near the works. They say that the saloon keepers smuggle liquor into the works and it is subversive of discipline.

An Air Valve Setting Machine.

A very simple and efficient device for revolving the main wheels of a locomotive during the operation of valve setting is that shown herewith, which is in operation at the Carbondale shops of the Delaware & Hudson. The idea was worked out by master mechanic W. C. Innis, who applied an ordinary air motor found in every shop where compressed air is used. On the spindle of the motor is fitted a worm which meshes into a worm wheel, and the latter being keyed to the roller shaft, imparts motion to same when air is turned on. The sprocket wheels and chain perform a like office to the second shaft, and transmits the turning effort to the drivers resting on the four rollers. One of the beauties of this scheme is that the wheels can be stopped at a tram center with absolute accuracy. There are some other kinks devised by Mr. Innis that we propose to give our readers from time to time.



INNIS AIR VALVE SETTING MACHINE.

Terry Bennett's Address.

BY SHANDY MAGUIRE.

The bulletin board of the R. R. Y. M. C. A. contained the following notice recently: "The last lecture of the course will be delivered by Mr. Terrence Bennett on the night of the 10th inst. Subject, 'A Heart to Heart Talk with the Boys.'"

On the evening in question Mr. Bennett didn't have to play to a beggarly array of empty benches. He came in on time, and found every seat occupied, with a goodly sprinkling of the fair sex among them. At the appointed moment the choir, consisting of seven voices, arrayed themselves around the organ, at which a young heart-breaker, about departing from her teens, presided. After the choir sang most musically "Wife, Children and Friends," the secretary of the association stepped upon the rostrum and announced the speaker. When Mr. Bennett came forward he was warmly greeted. He lost no time hemming and hawing, but took a header into his subject.

"Ladies and gentlemen, I have been requested to entertain the association on one evening during the present winter; so here I am. It is not necessary for me to disclaim being a public speaker in the sense in which I am here this evening, yet I couldn't deny having a small habit of outdoor vocalization, as occasion may require—or indoor, either. I see too many familiar faces before me to do any hocus pocusing with the truth, or say I am not in the habit of giving punctuated orations about hourly. I am aware that the proportions of many a well-developed bust of your wives and sweethearts do not owe their bewitching expansion to the affectionate regard in which I am held. However, ladies, you must remember that the devil may not be as black as he is painted. When your moustached deluders give a free rein to a prevaricating tongue, and make the round house foreman the storm center of their venom, behind his back, you can rest assured that, in the language of the craft, 'they deserved a jacking-up and they got it.' The Lord never had a selection made for that position from the church-going, sanctimonious souls of the rail. He, in His wisdom and glory, did not want to damn some men not all bad, but who did not carry a very heavy knapsack full of creed upon their backs; so sooner than roast them eternally He had them put where their expiation of sin would be so thorough, owing to the trials they were obliged to undergo, that their through pass, good on all trains to the New Jerusalem, would be ready the moment they were ready for it.

"We will now talk and listen to things we know more about than discussing the Kingdom Come. I shall devote my remarks to a brief discussion of the ability of men required to recruit the service of the Locomotive Department. There is a glamor of romance for a young man in looking at a locomotive engineer on duty; and he aspires to be one. As the surest way to get there, he applies for a wiper's job. He gets it, after he replies to a few questions, the most prominent one being: 'Are you willing to give honest service in return for the pay we give you?' The answer is invariably 'Yes, sir.' Before he is one week in the service he knows more about the parts he is to wipe than the man who hired him. The chances are more than favorable, that he has struck up a partnership, which will have a pernicious effect on his whole future existence on the road. What a splendid opportunity a new engineer has to educate himself, if he is only inclined! He is in what can be truly called 'the kindergarten of locomotive engineering.' An enquiring mind can note the machinery attached to the main driving axle, the eccentric cams, the straps surrounding the same, the blades reaching from the straps to the links, the block within the links, its attachment to the rocker arm, the rocker arm to the valve rod, then try and fancy the movement given to the valve within the steam chest, and why; all impelled by the motion of the axle, and the axle moved by them, making an interdependence harmonious and grand. An ambitious young man will, while in the pit, or wiping the parts available from the floor, begin to learn the names of them, and to grow more familiar with them. Do they all do it? Not on your life! Seven out of every ten become thoroughbred "Sogers" before fifteen days elapse, and by some mysterious method of acquiring pernicious knowledge, can tell just the spots to wipe, and give a lick and a promise to all the others. If they are reprimanded for not doing work as it should be done, with a fluency of gab worthy of a better cause, they can tell just what they must touch and what avoid. Circumstances mostly relating to the labor market may necessitate a grin-and-bear-it sort of resignation on the part of the foreman. He may have been a graduate from the pit himself, and had a very fair knowledge of how work should be done long years before the fathers and mothers of the wipers began throwing sheep's eyes at each other, strolling within the confines of some sweet-briar scented boreen in Paddy's land, or had yet arrived at the dignity of shoes, to protect their naked feet from the stone splinters of the roads in Italy, when cadging for grub.

"We will now suppose that the necessity of the service requires a fireman. With the elasticity of young manhood he jumps from the pit onto the deck. He is allotted his engine and his engineer. He goes out on his first trip and begins to find that he cannot sit upon the seat, gazing at the people and the houses as he passes. The gauge requires a little

of his attention, and the pointer is his bane. He learns that if he wishes to make a return trip he cannot devote so much of his time to the pantomimic movements of his idle hands, when he sees a female form at the doors or the windows of the adjacent houses. Besides, the lad in chief command, occupying the seat upon the right, is becoming a little restive. He manages to get back to the place of departure, but the illusion of the past, which glamorized his whole time in the pit, is knocked galley west. He tells his tale of woe into willing ears, and he is consoled by the listeners' telling him that the engineer does not know his business, and is to blame for all the discomforts he complained of, and assured that it was a wheelbarrow to which the engineer should have been assigned, but was given a locomotive to manipulate instead. He drinks in the nectared draught, and it does him good.

Now, ladies and gentlemen, we will go meandering away from the main track of my subject to dally a few minutes upon the siding. How often have we perused the eloquently written essays of enthusiasts on how to recruit the service? One in particular, which was gotten up in the most beautiful style of ornate language, by a chap in the General Manager's office, doing subordinate duty, attracted my attention. It was read before one of the prominent railway clubs of the country, and received marked notice from all exchanges, who used parts of the same. But for the fact that I have pocketbook proof that the pass privilege is annulled, I would not mention the reason that editors of commendable papers quote it. It was glorious reading. It described the sort of a biped the applicant for a wiper's job should be. His grandfather's and grandmother's habits were to receive close attention from the investigator. If their blood was sufficiently pure to transfuse into the veins of offspring, it was to be noted; the adolesence of the father and mother was to get most important attention; then the offspring must have positive proof that the union of his father and mother had been mutual and a family-raising certificate was awarded to them, after a rigid investigation. The young kid had to prove that he never indulged in any of the frisky tricks of youth, which would impair his manly vigor, or reduce his mental ability; and if the investigation was up to the standard of the writer's ideas morally, mentally, physically, intellectually and otherwise, the applicant was to be hired, so as to put him on probation for a future engineer. I got a little excited when reading the essay, and Martha noticed me—you all know who Martha is—she knew by my actions the deep interest I was taking in the paper stuck under my nose, and naturally she enquired what interested me so. I said, Oh, for a celestial incubator, to raise just such a crop of recruits for the round house pits, as the pen-pusher of this essay describes, was my explanation, and after she heard me read it, she seconded the motion, for she had a pretty good idea of the difficulty almost daily experienced, to get blackstrap, smoke-guzzlers for duty on the night trick; and she requested me to send the author a spring-scented bouquet with her compliments.

"Now is the time for a young fellow to get down to his work, to acquire a knowledge of his business, and to educate himself for the coming fray. Naturally he looks for promotion and the right side of the engine is his objective point. If he endeavors to obtain knowledge of his calling, he has a splendid opportunity in these days, as compared with a few years ago. He can secure books which were written by practical men, when in the harness. He can store up in his mind the big nuggets of information contained within their pages, for future need, and can add to them his own experience; and when the time arrives for him to go across to the responsible post of duty, he can have the consolation of knowing that in any position he may be placed in when plying the hazardous vocation, he can do as well as men of ability who were there before him. But, if he fudges an examination, so that he has succeeded in passing only, his skill as a pilot, navigating schooners of beer across the bar, will be but poor assistance to him when confronted with the many perplexities of the engine submitted to his charge. I have my ideas of what a locomotive engineer should be. I do not want him a paragon. I am not difficult to please. I want a sober, thinking man; one who is not satisfied with being able to throttle and keep water on the top of the crown sheet when making time; but one who studies out the relation of one part to the other. One who, when he goes to the report book, to enter within it the defects of the engine he came in with, can make his troubles understood by the repairers. I want a man cheerful and respectful. One who is willing to give the company more than a perfunctory service for the compensation received. One who is not continually going around in search of ills to be given to the Grief Committee to adjust. One who does not carry a schedule of what he is not supposed to do, in his vest pocket, for hourly reference. One who will not vaporize the track with steam blowing out from a piston or valve stem for many a mile, perhaps frightening animals while passing, sooner than make a jump and put in a turn or two at the first opportunity, because the schedule says it is not his business.

However, ladies and gentlemen, the percentage of indifferent jaw-workers is so small upon our locomotives, that I can take my leave of them, to testify my unbounded admiration for the noble army of men upon both sides of our engines, plying their calling upon our railroads to-day. Never from the dawn of history have nobler deeds of heroism been known than are done by men in the cabs. Men, for God or fatherland, go forth to meet the foe, inspired by either religious zeal or valor, keeping step to the drum beats of heroic sounds, side by side with associates who follow the flag to do or die, knowing that the eyes of the world are on them and ready to reward their efforts; but where are they alongside the two brave fellows who feel the jar that indicates leaving the rails at a speed of 50 or 60 miles an hour, who know it is but a question of seconds until their mangled remains will be unrecognizable by their dearest friends, and who, entirely thoughtless of themselves, devote their latest efforts to bring the train to a stop as rapidly as possible, and if they are not totally dead, as they are pinned under the wreckage, tell the rescuers to never mind them, but to get out a flag and stop approaching trains from danger. These are the men who deserve the medals for heroic deeds, but very seldom, if ever, receive them. I fervently feel that when the last trump is sounded, to awake the dead for final judgment, as the procession of the heroes of all ages and climes is moving by the Grand Reviewer, that the van of the limitless army will be led by men of the locomotive cabs, who upon the railroads of America, laid down their lives to save the passengers and property entrusted to their care; and shall be saluted by the Reviewer with "Well done, thou good and faithful servant; enter thou into the joy of thy Lord."

The Long Island Railroad Company has had a number of powerful passenger locomotives built at the Baldwin Locomotive Works in Philadelphia, and they will soon be added to the equipment of the road. There are eight new ten-wheelers, which are said to be of the most powerful type made. They will be used on the Montauk and main line and the north side branches.

The Toledo, Bowling Green & Southern Traction Company has recently purchased, from the Westinghouse Electric & Mfg. Co., a 250-kilowatt rotary converter, which will be used for supplying current to its lines. Power will be received in the form of alternating current from the Maumee Valley Electric Company, which is installing a 250-kilowatt, inverted, Westinghouse rotary-converter for the purpose, together with three 100-kilowatt raising transformers.

James Millholland.

BY E. J. RAUCH.

The name of James Millholland deservedly stands pre-eminent among those who contributed to the evolution, success and superiority of the American type of locomotive; especially those that successfully used anthracite coal as a fuel.

Of the early life of Mr. Millholland not much can be said, as it was comparatively uneventful until he engaged in railroad business. He was born in the city of Baltimore, on the 6th of October, 1812; and when of proper age entered the shops of a builder of steamboats and machinery in general, as an apprentice.

The first notice of James Millholland recorded in books concerning pioneer locomotive improvers, is that he was an apprentice under George W. Johnson, who had a machine shop in Baltimore, and to whom Peter Cooper turned over the "Tom Thumb" to be finished. James Millholland, who was called a remarkably bright boy, with a natural aptitude for mechanics, was Mr. Johnson's principal helper.

A few years after his majority James Millholland became the master mechanic of the Baltimore & Susquehanna Railroad. While with that company he developed the Napoleonic character that he kept through life, and which contributed so largely to his success. When he became imbued with an idea, he followed it to the end, whether it led to success or failure; determined to know what was in it; and it is not known that any one ever made a success of any idea that he failed in.

In those days there were many crank-axle locomotives in use. Owing to the imperfect and crude means of forging these cranks, many of them broke after short service. Mr. Millholland conceived the idea of trying a cast-iron crank as a substitute for the wrought one. He made the trial, and when he left the Baltimore & Susquehanna Railroad the cast-iron cranks were doing good service, and there is no record of one of them breaking.

In the spring of 1848 Mr. Millholland was called by the Philadelphia & Reading Railroad to take charge of their rolling stock as master mechanic. He found a very poor shop, with old tools and inferior appliances for getting out work. Fortunately, in a year or two after his advent in Reading, the shops burned down, and he rebuilt them to his liking. The company had a forge in which were several steam "helve" hammers (the "Nasmyth" steam hammer was not then known). These hammers did good service in faggotting scrap iron, and making car axles and other forgings for the blacksmith shops. Millholland saw where an improvement could be made in the forge. He soon learned that jealousy between the forgemen was a detriment to good results; that each hammer man felt that he ought to be "it." This was a condition bequeathed to him by his predecessor. He solved the problem by placing the forge under the control of the foreman blacksmith—Jimmy Mullin—who soon made matters work smoothly. One of the troubles to contend with was the locomotive tire. "Low Moor" iron was used exclusively, and much of it was bad, so that the tires mashed out in spots, necessitating turning off at frequent intervals. Added to this there were no double-head lathes in the shop on which to turn tires, and the lathe men used a diamond-pointed tool that took a cut about $\frac{1}{16}$-inch deep. Ten or twelve days were required to turn off a set of tires for an 8-wheel engine. Mr. Millholland tried making tries from scrap in the forge, and it was a grand success as far as he was able to supply the engines. He then put up a double-headed lathe and brought a man from the Baltimore & Susquehanna shops to run it. This man introduced a side-cutting tool that took off a shaving $\frac{5}{8}$ to $\frac{3}{4}$ inch wide, and from $\frac{1}{8}$ to $\frac{3}{16}$ inch thick. This relieved the tire question of its most knotty points.

There was a large amount of steel scrap lying in the yard for which there was no sale. Millholland had a Berks county forgeman turn a lot of this scrap into blooms from which he had a set of tires made and put on a Baldwin 6-wheel engine, "The United States," and these were the first steel tires of which there is any record; this was between 1853 and 1854.

The Philadelphia & Reading's power was a heterogeneous combination. Engines were from Norris, Baldwin, New Castle Manufacturing Co., Eastwick & Harrison, Braithwaite, Locks & Canales, Ross Winans, Dotterer & Darling, and perhaps others. In addition there was a number of engines built by the company from designs of Tredgold.

These engines were all under the control of separate foremen and gangs, and they were all independent of each other. When the new master mechanic came the most of these foremen had a chip on his shoulder. Suffice it to say none of these chips were knocked off, but in a very short time none of them were in evidence.

About a year before the advent of Mr. Millholland, the P. & R. had built an experimental engine to burn anthracite coal, and this was one of the legacies bequeathed to him. The machinery was carried on one frame and the boiler on another. Of course he was expected to make it go. The thing had been in service some little time under

SOUTHERN CALIFORNIA ENGINE EQUIPPED WITH SHEEDY CYLINDER CIRCULATOR. THIS DEVICE ENABLES PISTON VALVE ENGINES TO COAST AS FREELY AS A SLIDE VALVE ENGINE.

her builders' administration, but was a lamentable failure. A few attempts under Mr. M. to get the "Novelty" to make any showing enabled him to convince her projectors that the machine had better be scrapped, and she was.

One of the bad features Mr. M. had to meet was the drunkenness among the engineers, not more so perhaps than on most other railroads, but too much for good service. He took a number of steady young men from different departments of the shop—not confining the selection to machinists—and put them on engines under reliable men to learn to run an engine and handle a train. In a short time he had sober men to replace some of the lushers; and the effect was salutory.

In those days brass valves in steam chests and solid brass boxes on locomotive axles were in general use. Filing, scraping and grinding valve seats was the practice. This was all changed. Cast-iron valves in steam chest, solid cast-iron boxes with two brass strips in quarters and babbit in the crown were put on axles, and a hand planer faced the valve seats; and, much to the surprise of many, all the changes were successes. The first engine to be rebuilt by Mr. Millholland was a Norris 6-wheeler. In those days all engines had hook valve motion, and only one on the Reading road had a cut-off. The engine rebuilt was fitted with a cut-off—½ stroke—and was a success, saving at least 25 per cent. of fuel. He changed one or two Baldwin engines to cut-offs, but they were not a success on account of the steam ports being too limited.

On the first engine rebuilt by Mr. Millholland, as well as all subsequent ones, rebuilt or new, he put a dome on the boiler, forward, and put in a balanced throttle valve that took steam, by an arrangement of the dry pipes, from both domes. With this arrangement the boilers carried their water nearly at same level with open or closed throttle.

He made a number of minor experiments to burn anthracite coal in the wood-burner fire-boxes, and finally rebuilt a Baldwin 8-wheeler, the "Warrior." The fire-box was kept within the frame line until it reached back to rear of hind driver; there it spread to about five inches outside of the track. There was a grate door in rear of fire-box resting on the grates, and two solid doors on this grate door to put the coal through. This engine was the greatest success of any attempt to burn anthracite coal up to her advent.

In 1852 the company had their charter amended to enable them to build new engines, and the work on them commenced. It was thought that Millholland made a grave error in not following the beaten path that he had so largely helped to lay out. He attempted to make a success of what had been in England a failure, viz., water table boilers with a combustion chamber in interior of the boiler and in rear of the flues. There were seven of these engines built, and they were all failures. They could not be made to steam. The machinery of them could not be excelled. Not profiting by the experience with these engines, he built two passenger engines with boilers on same principle, *i.e.*, water tables and combustion chambers. They were named "Illinois" and "Michigan;" and were probably the handsomest locomotives ever built. The driving wheels were of wrought iron 7 feet in diameter. Cylinders, 17½ by 30 inches—weight, about 35 tons. The boilers would not make steam, and the cylinders were bushed down to 14 inches. Water tables taken out and replaced by a nest of 3½-inch flues; combustion chamber was left in place. The wrought-iron wheels proving too weak, were replaced with cast iron of 6 feet diameter. The engines were finally put into a mixed passenger and freight service, where they finally wore out.

In the building of engines for the road Mr. Millholland retained his love for the combustion chamber between two sets of flues; but finally gave it up and fell back to the straight flue, with as much grate surface as he could get. Then he built engines for all kinds of service that were peerless, and it is an open question if there are any better built now.

In 1865 Mr. Millholland resigned from his position of master mechanic and assistant superintendent, and went to the Mt. Savage Railroad as master mechanic. He remained there only a few years when he resigned and returned to Reading. After a short time he engaged in the banking business for several years.

Mr. Millholland amassed a competency—a handsome one; but money never affected his disposition. Those who knew him when he came to Reading and kept in touch with him to the end, never saw any change. He had no extravagant habits nor the taste for any, and yet was a jolly good fellow, when jollity was in order.

As a railroad official he was just and impartial in dealing with the men. No matter how much he disliked a man personally, that dislike did not affect the man's treatment, and vice versa.

If there is such a thing as luck, good or bad, good luck seemed to hang to Mr. Millholland's skirts; everything he took hold of came his way. One instance will suffice to explain. He bought the patent of a wooden spring for coal cars for a few hundred dollars, sold royalty to the P. & R. for a handsome price. Before the war he became one of the incorporators of the Leesport Iron Co., and was to put in the engines and blowing cylinders. He traded the right to make his wooden car spring for these engines and cylinders; then made a contract with the iron company to take his pay in pig iron— *on call*—at the then market price, about $18@$20 per ton. The war broke out, pig iron began to raise in price, and Millholland waited until his pig iron brought him $60 to $70 per ton. He once laughingly said that he had taken his pigs to a good market.

Mr. Millholland's declining years were marked by ill-health. His disposition to think his own way stuck to him to the end. His physicians—and he had the best in the country—all agreed that his trouble was of the lungs and treated him accordingly. He claimed his liver was the source of trouble. An autopsy proved he was right. He died August 18, 1875, sixty-five years of age.

New York, May 11, 1903.

Watering Can Necessary at Times.

On board one of the northern pleasure steamers, which have to be built with exceedingly light draught to get over the frequent shallows of the river, a Yankee tourist remarked to the captain, a shrewd old Scotchman:

"I reckon, skipper, that you think nothing of steaming across a meadow when there's been a heavy fall of dew?"

"That's so," replied the captain, 'though occasionally we hae to send a man ahead wi' a watering can."—*London Tit Bits.*

The Southern Pacific Company, with which the public invariably associate the Sunset, Ogden and Shasta routes, has just issued through its passenger department a big tree book in which the forest giants of California are partly reproduced in very clear half-tone illustrations. We say partly reproduced, because the only way one can get a whole California tree in a photograph is to snap shot it, end on. The big tree book is a tastefully executed souvenir of the Mariposa big tree grove in the Yosemite Valley. The book tells how to see the big trees, and is most interesting and instructive as well. Send for a copy to Mr. E. O. McCormick, passenger traffic manager, San Francisco, or to any of the passenger agencies of the company if you are interested.

The Southern Railroad Company appears to be adopting the policy of contracting to some extent for repairs on their locomotives. They have given the Kelley Locomotive Works a contract for repairing all their locomotives on the Mobile and Birmingham division that lie over at Anniston.

Where's the good of putting things off? Strike while the iron's hot.—*Barnaby Rudge.*

Of Personal Interest.

Mr. Patrick Kelley has been appointed shop foreman on the El Paso & Northeastern, at Alamogordo, N. M.

Mr. C. S. Lake has been appointed trainmaster of the main line of the Danville division on the Southern Railway.

Mr. Neil La Baum has been appointed round-house foreman on the El Paso & Northeastern, at Alamogordo, vice Mr. R. Ross, resigned.

Mr. G. L. Potter, formerly general manager of the Baltimore & Ohio, has been advanced to the position of third vice-president of that road.

Mr. H. J. L. Roberts has been appointed general foreman of the Canadian Pacific Shops at Revelstoke, B. C., vice Mr. S. J. Hungerford, promoted.

Mr. H. H. Maxfield has been appointed assistant engineer of motive power on the U. R. R. of N. J. Division of the Pennsylvania, vice Mr. John L. Mohun, resigned.

Mr. H. A. Williams, superintendent of the Norfolk Division of the Southern Railway, has had his headquarters changed from Greensboro to Pinners Point, Va.

Mr. E. E. Herr, round-house foreman at Cold Port, N. J., on the Pennsylvania, has been transferred in the same capacity to Camden, N. J., vice Mr. F. A. Smock, promoted.

Mr. J. Cooper, formerly of the drawing office staff, Pennsylvania Railroad, has been appointed foreman of the Waldo avenue round house, in Jersey City, N. J.

Mr. G. B. Williams, formerly chief clerk for the master mechanic of the Canadian Pacific, at Toronto Junction, has been transferred to Winnipeg, in the same capacity.

Mr. D. L. Bush has been appointed general superintendent of the Chicago, Milwaukee & St. Paul Railway, with headquarters at Chicago, Ill., vice Mr. J. N. Barr, promoted.

Mr. F. A. Smock has been promoted from the position of round-house foreman at Camden, N. J., to that of general foreman of the Meadow Shops of the Pennsylvania at Jersey City, N. J.

Mr. F. J. Buchbaum, round-house foreman on the Pennsylvania at the Waldo avenue shop in Jersey City, has been transferred to Cold Port, in the same capacity, vice Mr. Herr, transferred.

Mr. Otto E. Walter has been appointed assistant foreman of the boiler shop of the Brooks Works of the American Locomotive Company, vice Mr. F. G. Bird, transferred to Schenectady.

Mr. J. E. Sague, mechanical engineer of the American Locomotive Company, has gone on a two-months' trip to Europe to study foreign-built locomotives in the interest of his company.

Mr. J. W. Harkom, formerly mechanical assistant to the manager C. P. R. lines east of Winnipeg, has been appointed general superintendent of the Canada Foundry Company's works at Toronto.

Mr. H. B. Brown, formerly on the B. & O., has been appointed master mechanic on the Mahoning Division of the Erie Railroad at Cleveland, Ohio, vice Mr. F. Johnson, assigned to other duties.

Mr. G. H. Hedge, formerly locomotive foreman on the C. P. R. at Brandon, Man., has been appointed locomotive foreman on the Canadian Northern at Port Arthur, vice Mr. J. W. Blythe, resigned.

Mr. W. C. Parsons has been appointed superintendent of motive power and machinery of the El Paso & Northeastern system, with headquarters at Alamogordo, N. M., vice Mr. H. Ridgeway, resigned.

Mr. M. J. Horsey has been appointed chief draughtsman of Canada Atlantic Railway, with headquarters at Ottawa. Mr. Horsey was formerly with the Canadian Locomotive Company at Kingston.

Mr. S. J. Hungerford, formerly general foreman of the Revelstoke Shops of the Canadian Pacific, has been appointed acting master mechanic for line west of Broadview, with headquarters at Calgary Alta.

Mr. W. S. Cooper, formerly trainmaster at Milwaukee on the Chicago, Milwaukee & St. Paul Railway, has been appointed division superintendent of the river division, vice Mr. J. H. Foster, promoted.

Mr. J. H. Foster, division superintendent on the Chicago, Milwaukee & St. Paul, at Minneapolis, has been promoted to the position of assistant general superintendent on the same road, vice Mr. H. B. Earling, transferred.

Mr. B. C. Gesner, who for some time has held the positions of air-brake inspector and master mechanic of the eastern division of the Intercolonial Railway of Canada, has resigned his position to accept service with the Galena Oil Company.

Mr. Jacob Merle has been appointed general foreman of the Alamogordo shop on the El Paso & Northeastern system. He was formerly connected with the G. H. & S. A. and the National railroads. He is a shop manager of considerable experience.

Mr. C. C. Elwell, assistant superintendent of the Shore Line Division of the New York, New Haven & Hartford, has been appointed superintendent of the Air Line, Northampton Division, with office at New Haven, Conn., vice Mr. W. A. Waterbury, resigned.

Mr. J. E. Mulfeld, formerly superintendent of rolling stock of the Intercolonial Railway of Canada, has been appointed superintendent of motive power on the Baltimore & Ohio for the Cleveland, Chicago & Newark districts, with headquarters at Newark, N. J.

Mr. H. B. Earling, formerly assistant general superintendent on the Chicago, Milwaukee & St. Paul Railway at Marion, Iowa, has been appointed assistant general superintendent of the same road, with headquarters at Milwaukee, Wis., vice Mr. D. L. Bush, promoted.

Mr. George R. Webster has been appointed right-of-way superintendent on the Canadian Pacific Railway. This is a new title on the road. Mr. Webster will deal with the constantly increasing quantity of real estate. He will have to do with the laying out of new real estate acquisitions, and will report upon prospective purchases.

Mr. J. N. Barr has been advanced from the position of general superintendent of the Chicago, Milwaukee & St. Paul Railway to that of assistant to the president. Mr. Barr will supervise the motive power and rolling stock department of the company, and the West Milwaukee Shops will be very much enlarged and put in condition to build all locomotives required by the road.

Mr. W. O. Duntley, vice president and general manager of the Chicago Pneumatic Tool Company, has just returned from a short business trip abroad in the interests of his company. While on the Continent Mr. Duntley visited several of the most prominent shipyards, manufacturing establishments, etc., and brought back with him a large number of orders for the various pneumatic appliances manufactured by his company.

Mr. Thomas Tait, the former manager of transportation on the Canadian Pacific, was given a complimentary banquet at the St. James' Club, Montreal, on the occasion of his departure for Australia, where he will be chairman of the Victoria Railroad Commission. Farewell speeches were made by Sir Thomas Shaughnessy and the three vice-presidents. Happy things were said and

prosperity and success was predicted for the guest of the evening.

Mr. C. W. Werst, who has been general foreman of the locomotive department of the San Bernardino Shops of the Santa Fé, has resigned his position to accept the important post of inspector of work in the erecting department in the Baldwin Locomotive Works. Mr. Werst has for fourteen years been connected with the Santa Fé, and is a warm friend of Railway and Locomotive Engineering. His many friends wish him every success in his new position.

Mr. H. P. Knight has been appointed division master mechanic of the Baltimore & Ohio Railroad at New Castle Junction, succeeding Mr. H. B. Brown. Mr. Knight began railroad work as an apprentice in the Altoona Shops of the Pennsylvania, and has held the positions of assistant foreman of erecting shop on the Norfolk & Western, general foreman of locomotive repairs, on the Chicago & Alton, and foreman of the machine department in the Baldwin Locomotive Works.

Mr. J. W. Leonard, formerly general superintendent of the Central Division of the Canadian Pacific Railway, has been appointed assistant general manager of lines west of Winnipeg, with headquarters in that city. Mr. Leonard joined the service of the Canadian Pacific when that company took over the Credit Valley, a north Ontario line, in December, 1880. Previous to that he had filled various positions on the Credit Valley. He was made superintendent at Montreal in 1890, general superintendent at Toronto in 1893, and at Winnipeg in 1900.

Mr. F. A. Delano, general manager of the C., B. & Q. Railroad, recently gave an address before the engineering students of Purdue University upon The Comparative Development of American and European railways. Mr. Delano is one of that class of general managers who came from the ranks of the motive power department. His accurate and comprehensive knowledge of railway matters makes him easily master of such a subject.

Mr. T. A. Summerskill, superintendent of motive power of the Central Vermont, was seriously injured recently as the result of a peculiar shooting accident at his home in St. Albans, Vt. His house was visited by a burglar early one morning. Mr. Summerskill, on discovering a man on the premises, called loudly for help, in order to to prevent the burglar making his escape. Mr. Harry Hall, a neighbor, armed with a revolver, ran to render assistance. In the darkness each supposed the other to be the burglar, and in the fight which ensued, Mr. Summerskill was shot. The burglar, however, escaped.

Robert J. Gross, second vice-president of the American Locomotive Company, and his secretary, Charles M. Muchnic, mechanical engineer, are in Japan, meeting officers of the Japanese railroads, where 258 locomotives of the American Locomotive Works are now in service. From Japan Mr. Gross and Mr. Muchnic will go to Corea, China and Siam, returning to North China and to Russia over the Trans-Siberian Railway. From there he will go to Europe and North Africa. The trip will take a year. Mr. Gross is looking for business, and finds that the prospects for his company receiving orders for many locomotives from the far east are very encouraging.

Mr. J. L. Mohun recently severed his connection with the Pennsylvania Railroad to accept a position as mechanical engineer with the Western Steel Car & Foundry Co., whose main offices are in the Old Colony Building, Chicago, with works at Hegewisch, Ill. Mr. Mohun entered the service of the Pennsylvania as a special apprentice at their Altoona Shops on February 6, 1890, was made inspector on the P. R. R. division in August, 1897; assistant master mechanic, Juniata Shops, March, 1899; master mechanic at Lambertville Shop, January 1900, and was promoted to the position of assistant engineer of motive power for the U. R. R. of N. J. division in August, 1900, which position he held up to the time he left railway work.

Mr. Frank S. Gannon, formerly third vice-president and general manager of the Southern Railway and the Northern Alabama Railway, and general manager of the Alabama Great Southern, has been made vice-president of the Interurban Street Railway Company, with office in New York. The Interurban is the company operating the Metropolitan street railway of New York and other allied lines. Mr. Gannon entered railway service in 1868, since which time he has been telegraph operator on the Erie; clerk in the president's office, New York, Susquehanna & Western; terminal agent, superintendent's clerk and train dispatcher on the Long Island road; train dispatcher, depot master, train master, master of transportation and supervisor of trains on the B. & O.; general superintendent, New York City and Northern; general superintendent, general manager, Staten Island Rapid Transit; general superintendent of the New York division of the B. & O., and president of the Staten Island Railway. Mr. Gannon brings to his new position the fruits of a large and varied experience in practical railway work. He has been a strong advocate of train men studying the principles of their business and has urged them to read railroad papers. This has brought us hundreds of subscribers.

Softening Feed Water.

The Chicago, Milwaukee & St. Paul Railroad Company have devoted more intelligent effort toward mitigating the bad influences of impure boiler feed water than any railroad company in the world. The matter has been long under the direction of a very efficient department of chemistry, under whose direction feed water has been treated so that the boilers give less trouble and make more milage than the locomotive boilers belonging to any railroad in the Northwest. The company appear now to have come to the conclusion that even their best efforts can be made better and that those who make the softening of feed water their particular business are likely to do the work more efficiently than the chemists belonging to the road. They have accordingly given a contract to the Kennicott Water Softener Co. for the installment of one plant, and if it proves as satisfactory as they expect others will be put in, so that the regions where the feed water is particularly bad will be robbed of their terrors for enginemen.

The department of chemistry is a very useful one when it keeps to the business of analyzing the quality of material supplied to the company. There is, however, considerable temptation for the members of the chemistry department of a railroad to become manufacturers when they find out the exact cost of the material their employers are purchasing. The chemist frequently sees big profits that do not realize in practice. When a railroad chemist succeeds in inducing the railroad company he serves to become manufacturers of oil, paint, soap or other material which can be bought by competition in the open market, he is leading his superior officers to engage in an enterprise likely to be expensive in the end. When he interests himself financially in starting the manufacture of goods to be supplied to his company, or of appliances which he can influence his company to purchase on the pretense that they are superior to others on the market, he is using his influence against his employers for his own personal benefit. The laws of competition may be depended upon to provide railroad companies with all kinds of material and appliances at reasonable rates, so there is no advantage in permitting their employees to become their manufacturers.

We have on our list at present several good men looking for positions as general foreman or master mechanic. We do not recommend any but efficient men, so superintendents of motive power looking for help will find it an advantage to correspond with us.

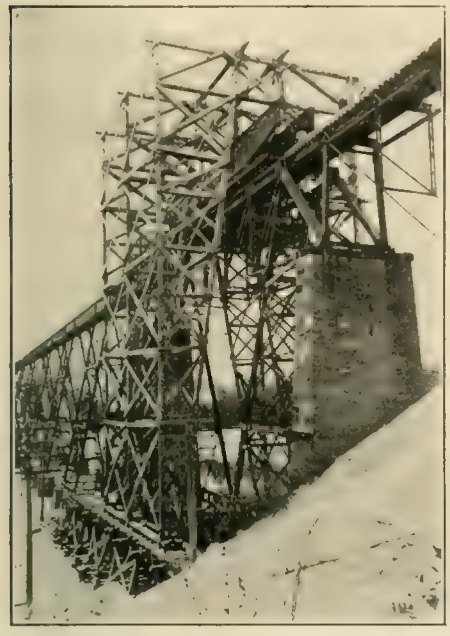
There is no royal road to learning, and what is life but learning.—*Our Mutual Friend.*

Over the Nickel Plate.

(Second Section.)

BY ANGUS SINCLAIR.

After a remarkably short wait at Buffalo, considering that it is the terminus of one railroad and the beginning of another, we were again speeding westward, this time on the New York, Chicago & St. Louis Railroad, popularly known as the Nickel Plate Line. As the train was working into speed amidst the labyrinth of tracks, I could not help going mentally backward to a time when there were no sleeping cars running through long distances. Now the passenger remains in luxurious ease over numerous junction points where he used to change cars, often after tedious waits and the worry of uncertainty of getting into the proper train. It is only those who have traveled before the sleeping-car era that realize the misery escaped and discomforts avoided during a protracted journey.



GIRARD, PA., BRIDGE, NICKEL PLATE LINE. SHOWING METHOD OF ERECTION.

There are many more people who travel all night in day coaches than there are in sleepers, the proportion is about 5 to 1; but those who have to lounge throughout the night on a seat three feet long or even occupy the half of it, pass through an ordeal not to be envied.

But go back still further to the romantic stage-coach days and think of a night and day journey hemmed inside of a coach rattling over iniquitous roads.

While on this subject my readers will perhaps excuse me for giving an extract from one of my note books about a night journey in the region I am traveling in. "At Port Jervis a six-foot-and-a-half lumberman enters a sleeper, and is disgusted to find all the berths taken. Finds a seat in the day car, and prepares to make himself comfortable. Takes off his boots and rests his feet on his bag to keep them off the floor. After a brief trial finds his legs in the way, and slides them up to the top of the seat in front. Body and legs now form an inverted N, and he falls asleep. When the conductor rouses him half an hour later to ask for his ticket, he imagines that his neck is broken, but it has only got the cramps. He decides to try another plan, so he takes his bag to use as a pillow. As he lays his cheek upon it, he finds that the bag has picked from the floor an abandoned chew. He says —— —— two or three times, and then he takes out his knife and scrapes off the tobacco. After that he lies down and stretches his legs over into the aisle. "Comfort at last," he grunts, and has just fallen asleep when a man comes along to take a drink, and calls upon him to take his legs out of the passage. He holds them in a perpendicular position like the draw of the tower bridge until the man gets through going and returning. Again he goes to sleep, and has hardly begun to snore, when another passenger demands the right of way to the water cooler. By the time that eleven others have taken their turn, and the trainmen have claimed the right of way seven times, he decides that it is better to sit up.

After a time he prevails upon a brakeman to turn the back of the seat next to his, which was empty. Taking his bag for a pillow, he curls himself into an irregular U, and occupies both seats. He is now comfortable, and dreams that he is visiting Florida; but presently the scene changes to the Arctic regions, and he imagines himself searching for the North Pole. On awakening with a start, he finds that the passenger who went out at Corning had forgotten to close the door, and a zero wind is blowing in at forty miles an hour. He blesses the careless passenger as lumbermen bless, prepares to warm up with a drink, but finds that his bottle has got broken, and he remarks again —— —— and walks in the aisle to renew his circulation. By the time he reaches Buffalo he has made up his mind to adopt the practice of engaging a sleeper a month ahead or of staying at home."

But that is not doing justice to our journey over the Nickel Plate Line. As we are speeding along by the shining Lake Erie, through a well-cultivated country just rolling enough to banish monotony, the Truthseeker, who is a member of the party, asks, "Why Nickel Plate?"

That calls for reference to another note book which says: "Senator Brice built the New York, Chicago & St. Louis Railroad, paralleling the Lake Shore & Michigan Southern from Buffalo to Chicago, for the purpose of selling out to the Vanderbilts, who own a controlling interest in the Lake Shore. Operating of the road began in 1882, but the scheme of selling was slow of fruition. The principal owner of the road kept up such an annoying fight by means of rate cutting, that after a struggle of seven years' duration, and the rejection of repeated offers, Mr. Vanderbilt yielded. In giving up he remarked that the price was outrageous and enough to "nickel plate the line from Buffalo to Chicago." The expression got into the papers and the name first used in derision became popular, and it will probably stick to the property as long as it is a railroad.

TRESTLE ON NICKEL PLATE LINE.

Like all things made merely to sell, the Nikel Plate was originally an inferior railroad, and for a time the Vanderbilts did not display any inclination to improve it, but of late years a different policy has been adopted and the property is becoming first class in every particular.

Since Mr. W. H. Canniff, the present

president, was elected in 1898, the road has been practically rebuilt, being laid with 65-pound steel rails throughout. Although the railroad traverses a fairly level country, it crosses a great many water and ice excavated ravines that require expensive bridging and trestling. That work was originally done as cheaply as possible, and the company are now making heavy expenditures on desirable improvements. Since Mr. Can-

ABUTMENT OF GIRARD, PA., BRIDGE, NICKEL PLATE LINE.

niff took hold they have renewed seventeen iron bridges, replaced four wooden trestles with iron, and filled forty-eight wooden trestles, all of which was charged to operating expenses. During this time they have added materialy to the locomotive, passenger and freight-car equipment.

Besides these important betterments, they paid, in 1900, 5 per cent. on the first preferred stock, 2 per cent. was paid on the second preferred stock, being the first time that was done in the history of the road. The succeeding two years 5 per cent. was paid on the first, and 3 per cent. on the second, a magnificent testimony to first-class management.

The illustrations of bridges which I am able to present, through the courtesy of Mr. Walter B. Wright, secretary to the president, give a good idea of the magnitude of that work; but there are many others quite as large which I am compelled to omit for want of room.

The speed of the trains is not high, but it is fast enough for comfort, and is little behind the fatest expresses in the country. The smooth road-bed and easy-riding cars make the journey of fifteen hours from Buffalo to Chicago a pleasant holiday outing, which even a feeble invalid in my own party found enjoyable. The dining cars are operated on the restaurant plan, and deserve to give universal satisfaction, for a great variety of well-prepared food is ready to satisfy nearly every taste.

Most of the scenery is mild compared to the imposing scenes of the Lackawanna, which we had just passed through; but there are many rugged glens and other attractive spots that delight the eye of the traveler. Many of the gorges crossed are grand, and are the bottom of pretty valleys, while the creeks and rivers, though comparatively small, lend variety to the woods, green pastures, spreading vineyards and wav-

VERMILLION TRESTLE, NICKEL PLATE LINE.

ing grains, that form the leading features of the waysides. Lake Erie is in sight for many miles, and its sparkling waters convey the restful air which attracts the weary, the sick and the overworked to seek rest and health in river and lake resorts.

Most of the journey of 523 miles from Buffalo to Chicago is through land as fertile and as intelligently cultivated as anything to be found in the United States, and other sources of wealth have been bestowed abundantly upon the dwellers in the different regions. The ordinary traveler usually associates grape culture with a semi-tropical climate, but we are scarcely away from Buffalo when we enter farms devoted to grape culture, and they extend with little interruption for hundreds of miles. Chautauqua county, once famous for its cheese and other dairy products, now raises little else than wine in the lake townships.

There is a curious commentary on human nature in people turning from dairying to wine production. This Chautauqua county was largely settled by Scotch-Irish, who are even more conscientious than the single race they sprung from. I knew a Scotch-Irish farmer in Iowa who was in a district noted for raising barley, but he would sow none of it for fear it should be turned into what he called "Devil's Drink." There must have been severe racking of consciences in Chautauqua before the farmers changed from the cow to the wine press.

In spite of the backsliding of Chautauqua's lake border, the land along which the Nickel Plate Line runs is still flowing with milk and honey, with additions of wine and the oil known as petroleum. There are also forests where oak, black walnut, hickory, pine, hemlock and other trees of a marketable size await the axe. One of the occupations I have followed, during a somewhat varied career, was that of a hunter of timber suitable for ties. To this day when I look at a tree I make a mental estimate of how many ties could be got out of it. From personal observation I noted that there are still many ties in growth where the Nickel Plate runs. There are also numerous farms where corn grows high and fat swine are to be seen turning it into a higher food. Wheat has not altogether disappeared, and all the other small grains I could think of may be seen in luxuriance absorbing the sun's rays to stimulate the soil element into producing abundant harvest. All riches come from the soil, and there is a fine foundation for wealth in the strip 523

miles long, which gives a share of its products to the Nickel Plate to carry.

Manufacturing towns are not wanting After leaving Buffalo with its varied industries, we get a glimpse of Dunkirk, which is now the third town in the country as a locomotive producer. I do not intend to convert my letter into a guide book, and so I can merely mention Cleveland, Fort Wayne and Hammond, because they are the largest freight producers on this line. But there are many small manufacturing places which aggregate big business, as the small brooks feed great rivers.

When one looks into details, it is not surprising that the Nickel Plate has become a dividend-paying property.

A Truly Fast Run.

On May 25 an extraordinarily fast run was made with the Twentieth Century Limited train on the Lake Shore & Michigan Southern. The run was continuous, over two divisions. On one division a Brooks ten-wheeler, with cylinders 20x 28 inches, driving wheels 80 inches diameter and 2,890 square feet of heating surface was used. On the other division was a Prairie type engine with cylinders 20½x28 inches, driving wheels 80 inches diameter and 3,356 square feet of heating surface. They hauled a train of four heavy Pullman cars 307 miles in 292 minutes. One stretch of 133 miles was made in 114 minutes. The average speed for the long distance was over 63 miles an hour, and for the spurt of 133 miles, 70 miles an hour. During this part of the run the speed frequently reached 90 miles an hour, or forty seconds for each mile. This is no record based on guesses, but is taken from the train dispatcher's reports.

Work; don't make fine playing speeches about bread, but earn it.—*Ralph Nickleby.*

The Kelso Freight Car Coupler.

The Kelso coupler is made by the McConway & Torley Company, of Pittsburgh, Pa., and in it are embodied all the good points of the well-known Janney coupler. The Kelso has been designed to meet the most severe service conditions. The knuckle has a lip at the back, and when in position this passes through the coupler wall and so relieves the knuckle pin of part of the strain. An additional feature is the "lock-set" arrangement. By means of this, when it is desired to uncouple a car, the operator simply raises the uncoupling lever, and the knuckle lock is then held out of the way of the knckle shank and the cars may be drawn apart, and the opening of the knuckle brings the locking mechanism into position for coupling by impact. The uncoupling lever does not require to be held up or locked up. The raising of this lever places the "lock set," and the operation is complete, and, further than this, the lock will not drop to the coupling position until the coupler has swung through eighty per cent of its total outward movement. The lock cannot be shaken down by a slight movement of the knuckle. It is therefore positive in its action.

There is another function which is performed by the knuckle-lock lifter, and that is that when the knuckle is closed, the former drops down and holds the knuckle lock so that it cannot move. In fact this has been called a "lock to the lock," as it effectually prevents any possible chance of the knuckle lock working up and so allowing the knuckle to open when in service.

ROCKY RUN BRIDGE, NICKEL PLATE LINE.

STATE LINE TRESTLE, NICKEL PLATE LINE.

The rush of business on the Illinois Central in recent months has been so great that it has been found almost impossible for the machinery department to handle it. As a result of this the company has leased a number of locomotives to be used on its system during the rush. Some of them were leased from the Union Transfer Company, of Chicago, and from other locomotive owners, to whom the high rental paid is a consideration.

The Baltimore & Ohio Company will order from 100 to 150 new locomotives for delivery during 1904. These additions will represent an outlay of from $1,500,000 to $2,300,000. When it is recalled that the Baltimore & Ohio has spent in the past two years, including the locomotives now under construction, close on to $5,000,000 for motive power, the growth of the traffic and the liberal efforts being made to take care of it are evident.

The Rand Drill Company report the removal of their San Francisco office from 223 First street to the Rialto Building, additional space being needed because of the rapidly expanding business of this company.

Fast Passenger Engine for the Illinois Central.

The Rogers Locomotive Company, of Paterson, N. J., have recently supplied the Illinois Central Railroad with some good examples of the now popular 4-4-2 type of locomotive for passenger service.

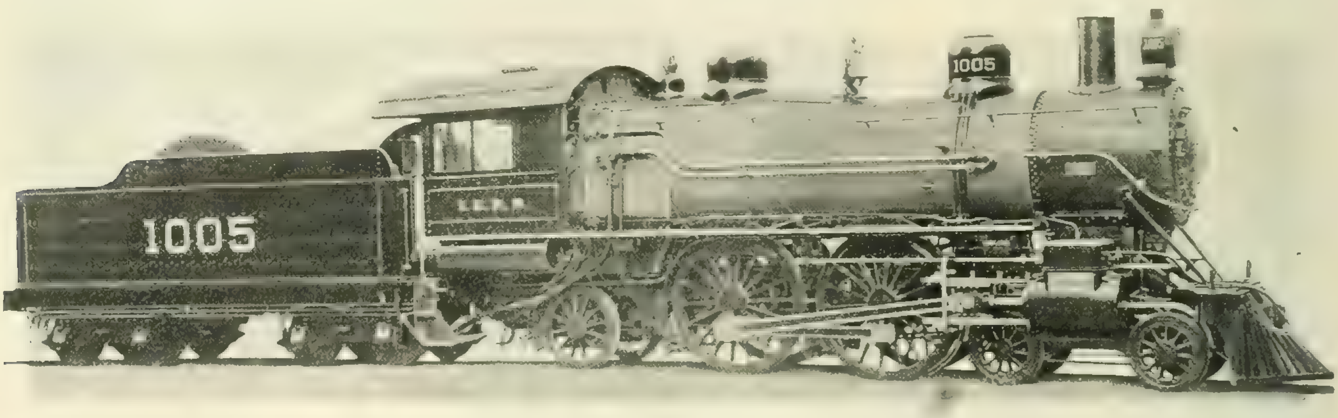
The cylinders are 20x28 in. and the driving wheels are 79 in. in diameter. The engine is simple, with ordinary slide valves, actuated by indirect motion. The rocker arm is between the driving wheels, and as the eccentric rods pass beyond the rocker the transmission bar works back from link to rocker. The crosshead is of the allegator type with top guide recessed so that outer edge of bar and guide are flush. The weight of the engine in working order is 188,000 lbs., of which 102,000 lbs. rest on the drivers. The engine truck carries 45,000 lbs., while the wheels at the rear bear 41,000 lbs.

The boiler is of the extended wagon-top type and measures 66 in. at the smoke box ring. The pressure carried is 200 lbs., and flexible or expansion stays are used in the critical rows in fire-box side sheets and in throat sheet. Water is supplied by two injectors placed on the right side, both delivery pipes enter the boilers at the same point, there is close to each injector a line check valve, and two globe valves are placed where the top check is usually located, which can be shut off or opened as occasion requires. The grate area is 35 sq. ft., and the total heating surface is 3,129 sq. ft.

The tender is carried on a steel frame made of 12-inch channels, Fox steel trucks are used and Paige wheels. The tank capacity for water is 7,000 gallons, and for coal 12 tons.

A few of the leading dimensions are given below:

Cyl., 20x28 in.; drivers, dia., 79 in.; driving wheel bse., 7 ft. 3 in.; tot. wheel bse. of eng., 27 ft. 9 in.
Weight on driv., 102,000 lbs.; on truck, F, 45,000 lbs , B, 41,000 lbs.; total, 188,000.
Heating surface, tubes, 2,954.5 sq. ft.; fire box, 174.7 sq. ft., tot., 3,129.2 sq. ft.; grate area, 35.01 sq. ft.
Tubes, out dia., 2 in.; length, 16 ft.; thickness, 11 in. B. W. G ; number, 331.
Boiler, type, ex. wagon top; dia., outside front, 66 in.; working pressure, 200 lbs.
Wheels, eng. truck, dia., 36 in., Paige; trail., 48 in.
Tender, cap., 15 tons coal; 7,000 water bot. gals.; frame, 12 in. steel channels; trucks, Fox; wheels, dia., 38 in.; kind, Paige.



ROGERS ATLANTIC ENGINE FOR ILLINOIS CENTRAL.

Meeting of the American Railway Association.

At the last semi-annual meeting of the American Railway Association, held in New York two very interesting reports were presented. One was by the committee on standard dimensions of box cars, and the other was from the committee on car service.

The first mentioned report called special attention to the idea which has got abroad that the preference in classification given to the standard car will make the large car useless. This opinion is not well founded, because while the large car will not have an advantage over smaller cars as heretofore and will not in the future be built, yet it can be used economically until worn out. The chairman of one of the classification committees, after a careful examination, estimates that 95 per cent. of all commodities can be so carried when housing conditions are favorable. The committee further urged that all advantages which appear to arise from discrepancies in classification and other regulations which may interfere with use of the standard box car, should be considered secondary.

The car service committee dealt fully with per diem. It appears that for the last six months of 1902, the percentage of home cars on roads making returns was 9.6 per cent. more than the year before. The per diem plan may be said to have accomplished the ends for which it was devised. It has given car owners better control of their own equipment. It has increased the revenue derived for the use of their equipment by others, and it has enabled railroad companies to check the car service accounts of other roads where their own cars are concerned.

To bring about these desirable ends there has been increased cost. Railroads which have done a large portion of their business in the cars of others have had to pay accordingly. There has been a further cost for additional clerical work and correspondence. Also a number of roads have found themselves short of power when their own cars came home, and these roads have been unable to promptly return foreign cars. Both of these causes have probably tended to reduce the average mileage per car per day. In the last six months of 1901 the average was 21.6, while in the last six months of 1902 it was 20.8. Another cause for this may probably be found in the fact that there has been an enormous number of freight cars in service. It is estimated that there was an increase of 100,000 freight cars on all the railroads in the country. No modifications in the rules governing the per diem system have been recommended as yet, as it was deemed advisable to wait another six months, when fuller records will be to hand.

Progress was reported by the committees on train rules, safety appliances, statistical inquiry and the standard cipher code. Mr. A. W. Sullivan, assistant second vice-president of the Illinois Central Railroad was again elected president of the association.

The Vitrified Wheel Company, of Westfield, Mass., has issued an illustrated catalogue descriptive of the corundum wheels made by their vitrified process. The company also manufacture emery and silicate wheels, emery cylinders, wheel dressers, emery bricks and corundum rubs. There are illustrated and priced, fifty-three special shaped wheels, with cipher telegraph word for ordering. The catalogue also gives the various grinding machines made by this concern, with dimensions, weights and prices. Write to the Vitrified Wheel Company for the catalogue if you are interested.

Hints on Break-Downs.

With the big engines of to-day some engineers thoughtlessly send for the shop force in case of break-downs when repairs should have been made by them. Often this is a cause of great expense and reflects no credit to the engineer. Very often it causes his endless worry explaining to the officials why he did not do the work himself.

It is for the young and the old thoughtless runners that the following advice is given:

In case of a broken forward cylinder-head, rocker arm, link, eccentric or strap, never take down a main rod, for you still need the rod to help you. You cannot do any damages to the cylinder. If you stop to consider that with ordinary engine oil you make 50 or more miles with one oiling of the eccentrics and the amount of hard work they perform, there is no reason why a good oiling with valve oil should not carry the piston the same distance without damage to itself and cylinder. Taking down a rod means unnecessary work for you and extra work for the shop.

Engines of to-day cannot be moved with one pinch-bar on the road when it takes four or more to move them in the shop. Leave up your rod, disconnect valve stem, and after covering ports, clamp it. Should you at any time stop on the dead center, shift valve on disabled side so as to admit steam to cylinder, move her off the dead center, cover port again, clamp stem and proceed. You have used your rod as a pinch-bar, saved yourself time, and the operation need not consume over five minutes.

Don't remove the chest cover for a broken valve yoke. Invariably, if your engine breaks a yoke, you will, in your endeavor to locate the side, put the good side on the dead center.

Don't worry, leave that to your neighbors.

If you cannot find any visible defect in the running gear and cannot move the engine, remember, that the good side is "*always*" on the dead center, and the disabled side on the quarter.

In this case disconnect valve rod and shift valve by hand. Move your engine off center, then remove relief valve casing, cover ports and clamp rod. Insert a wooden plug of sufficient length into casing to hold the valve in place and screw it back into chest. In this and the previous case disconnect the cylinder cock rod on the disabled side and block cocks open. Be sure and do not remove the main rod.

Where you are running an engine, whose eccentrics have no keys, and have to rely on set screws entirely, it is a good plan to look out for and be prepared for such accidents. A few minutes' work before starting your trip may relieve you from an embarrassing position, if you will follow these directions.

Setting valves by the third spoke of driver, or marking valve stem is very uncertain of good results. The method mentioned here is far superior, infallible, and consumes less time.

Place your engine as near the forward dead center as you can, let the reverse lever down into the extreme forward notch of quadrant. Take an inch chisel resting one-half on the guide and the other half on the cross-head and mark them. Now mark all four eccentrics and straps in the same way, and on a line with top edge of eccentric blades, while the engine is in this position. If the engine has blades with slotted holes, mark them also at end of strap.

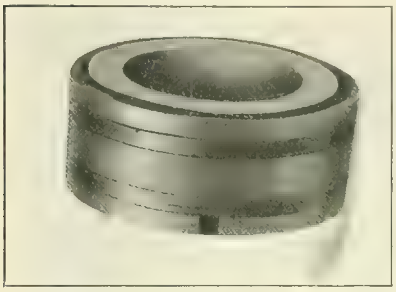
Should you at any time slip an eccentric, place the engine in the same position as when you marked eccentrics, being careful to note that the marks on cross-head and guide correspond. You will find that three of the marked eccentrics will correspond to the marks on straps and the one that is out will have the mark separated. Shift this eccentric around to mark on strap and secure it. You will have your engine as square as the valve-setter left her for you, and you need not call upon him. Follow these instructions and save yourself grief.

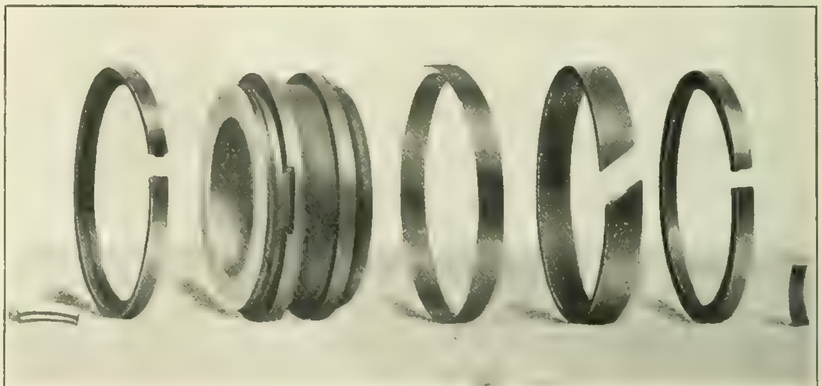
Photographed by N. Lazarnick. PRESIDENT ROOSEVELT TAKING A RIDE IN AN ENGINE.

Some parties in St. Paul are experimenting with a magnetic appliance by which the adhesion is increased between the driving wheels and the rails, obviating entirely the necessity for using sand. Inventions of this kind have been tried repeatedly, but it was always found that they increased the resistance in proportion as they increased the adhesion.

Roberts' Self-Adjusting Piston Packing.

The Roberts' improved self-adjusting piston packing can be used either with water or steam air or ammonia, and it can be applied to any kind of piston. It consists of seven parts, there is one bull ring, two packing rings, a proper center ring, a spring, and two joint pieces. The two packing rings and the center ring are fitted into grooves in the bull ring. The center ring which has a spring underneath it, is intended to carry the weight of the piston in the cylinder and to keep it running true. The packing rings are steam expanded, and as a consequence only one is acting during each stroke, thereby reducing the friction; the two steam joints are fitted in the rib of the bull ring and this prevents either ring from turning, and effectually removes all chance of a blow. The steam rings have a groove into which the steam joints fit with a tongue and they are dovetailed so in order to allow the steam rings to wear down and yet do their work. The steam joints will also prevent the rings from falling out in the cylinder. It is claimed that by the use of this packing the friction of the piston is greatly reduced. The Roberts' Company, of South Fourth street, Philadelphia, will be happy to forward their pamphlet on the subject, or supply any information concerning it to those interested enough to apply to them for it.





No Combination for Baldwin's.

"There is no combination between the American Locomotive Company and the Baldwin Locomotive Works, nor will there be," said Alba B. Johnson, answering a press agent.

His assertion was made in reply to a rumor printed in a financial news sheet of a combination affecting the Baldwin Works, the American Locomotive Company and the Rogers Locomotive Works. While it has been suggested that in time the Rogers plant and the American Company might come together, it has been emphatically denied that the Baldwin Works would entertain any proposition.

"I do not know whether there are negotiations on between the other two," said Mr. Johnson, "but there is absolutely no truth in the story that we are in any deal. There have been no overtures to us lately, and if there were, we should not entertain them. Neither in the question of a combination or prices is there any agreement or understanding, nor will there be."

The Time for Betterment of Railroad Property.

Railroad companies have expended sums of money during the last two years in making betterments on their properties, but there appears to be a lull in this kind of enterprise at the present time. Quite a number of railroad presidents have just realized that material and labor are now so high that the cost of betterments severely depletes the net revenues. The talk now is to wait until the inevitable hard times reduce the cost of labor and of material.

At the first glance this would seem to be sound financial policy, but we are afraid that it will delay betterments indefinitely. When a railroad company is prosperous, and is making lots of money, the expenditures for improvements are not felt very heavily, but when hard times come, Wall street influences demand retrenchments at every point where expenditure of money is not absolutely imperative. The consequence is that when material and labor are cheap nothing is done, and the companies put off the evil day of spending money until they cannot put it off any longer. Revival of business eventually makes it absolutely necessary to make large expenditures on equipment, and the betterment of the permanent structures, which is generally done when it costs most.

There have been a good many flush times, and a good many panics and depressions since the railway era opened, and the same experience is gone through every time. We do not see that it will ever be any different as long as Wall street influences are more powerful than those of the railroad presidents. No institution dominated by Wall street influences, be it devoted to operating railroads or to manufacturing goods for sale, will ever be able to profit by the cheapness of hard times. The people who speculate in stocks provide for no future. They want the return of profits immediately and will not wait for the harvest that comes from judicious sowing and carefully nurtured crops.

The Locomotives of the Great Northern of England.

We have just received a copy of a book written by Mr. George F. Bird, which is the history from 1847 to 1902 of the locomotives of the Great Northern Railway of England.

A very pleasing portrait of Mr. H. A. Ivatt, the present locomotive engineer of the company, forms the frontispiece. With an introduction, the book deals with what we may call the administrations of Archibald Sturrock, Patrick Stirling and Mr. Ivatt and recounts the work done in the locomotive department under each of these men. There are numerous line cuts showing the various types used at different times, and a photogravure of the famous "eight-foot singles" of Mr. Patrick Stirling and also of the more modern "singles" or 4-2-2 engines designed by Mr. Ivatt.

The book is published by the Locomotive Publishing Company, Limited, 102A Charing Cross Road, London.

A Few Points on Grinding.

Mr. Charles H. Norton, of the Norton Emery Wheel Company, of Worcester, Mass., has written a little treatise called "A Few Points on Grinding," and what may be called the text upon which Mr. Norton bases his exceedingly interesting discourse is that "There are signs that very much work now done by cutting will be done by grinding, and those soonest informed upon the subject will profit by it." The author tells an amusing story and a pleasing story of grinding which reminds us of a story we once heard of two high-priced workmen in a

locomotive shop in the days when "shop appliances" were in their infancy. These men were working piece work and were surrounded by pneumatic tools, flexible shafting and all sorts of "labor savers," but they were not using a single one of them. When asked why they worked away so hard by hand at everything they replied, "We simply haven't got time to monkey with the blamed things. We're too busy!"

Mr. Norton says that a certain manufacturer purchased a cylindrical grinding machine and received with it a wheel for soft steel and one for cast iron. An operator from the grinding works saw them grinding a Corliss valve with the wrong wheel, and on speaking to the manufacturer about it, the grinder-man was told that it saved time and did the job splendidly, and that the shop couldn't afford the time to change wheels for every different thing because results were so far superior to old methods. The operator got permission to do the job with the right wheel, and throwing in time of changing wheels, it turned out that more than three-quarters of the former time was saved by the use of the right wheel in the right way on the right job. Oh yes, gentle reader, it sometimes does pay to "monkey with the blamed things." Write the Norton Company to send you their little book and you won't regret it.

CASWELL DUMP CAR—DROP DOORS CLOSED.

CASWELL DUMP CAR—DROP DOORS OPEN.

The Caswell Dump Car.

The Caswell level dumping car was designed for the carriage of materials usually hauled in gondola cars. The idea being to provide for the dumping of the load quickly or for unloading with shovels if required.

With these objects in view the car is constructed with a perfectly level floor, without inclined surfaces or projections or parts to manipulate. The floor is as clear as that of a flat car and most expeditious shoveling can therefore be done on it, and moreover, the maximum capacity is thus secured. In order to dump the load, drop doors are provided in the floor near the sides of the car, and these extend from end to end so that the lading may be discharged either in sections or all together.

The drop doors are opened, closed and locked by rotating geared shafts, manipulated by a fixed ratchet lever which, after the doors are closed, is put into a receiver and is sealed with the standard car seal in order to prevent the shafts turning by accident or otherwise, until it is necessary to discharge the load.

As will be seen from our engraving showing doors open, there are ribbed malleable iron transoms between each door, placed below the level of the floor. In each of these castings there is a slot which slopes toward the center of the car, and the lower face of this slot is a toothed rack. The rotating shaft passes through all these slots and out through similar slots in the body bolsters and the end sills, and the pinions fastened to this rotating shaft engage with the racks. The outer ends of the racks do not slope in conformity with the long slot, they are level, so that when the doors are in place the weight is borne directly on the pinions with no strain on the teeth, and there is no effort on the part of the shaft to turn.

When it is desired to dump the contents the shaft is rotated and the pinion rolls toward the center of the car. When the pinion, together with the shaft, reaches the inclined portion of the racks, the weight of the lading on the drop doors is sufficient to roll the shafts down the inclines, thus opening the doors to 45 degrees. To raise the doors to the level of the fixed portion of the floor, the shafts are turned with the ratchet lever in the opposite direction and they will carry the doors, which rest on rollers secured to the shafts, up in front of them into place and securely lock them there.

A good deal of attention has been given to simplicity of construction of the Caswell Dump Car. And while it is not claimed that this car is absolutely self-cleaning, the load can be removed in the same average time as from self-cleaning hopper dump and convertible cars. Every part of the Caswell car is built in accordance with M. C. B. Standards. It is easy of inspection, replacing parts and repairing any portion of the operating mechanism is a simple matter and is inexpensive.

The offices of the Caswell Car Company, which controls the sales of these dump cars, are in the Fisher Building, Chicago, and the company invites correspondence.

Owing to the scarcity of motive power on the Pennsylvania Southwest system, the Pennsylvania Railroad will give the Panhandle 20 of the engines ordered for the Pennsylvania Railroad, and now being built at the Baldwin Works for immediate delivery.

The Tabor Mfg. Co., of Philadelphia, have arranged with the Draper Co., of Hopedale, Mass., for the manufacture and sale of the Hand Rammed Molding Machines, which the latter firm has been building for its own use. The Draper Co. have had probably greater experience in moulding by machine than any firm in this country; consequently their machines represent the result of years of experimenting. At present they have in operation in the Hopedale plant several hundred of these machines, which are light, and are mounted on wheels, and do not require power to operate them. Moreover, they are cheap.

Byrd's Flue Welder.

There is a very efficient tube welder to be seen in the Winnipeg shops of the Canadian Pacific Railway. It was invented and patented by Mr. Walter Byrd, the general foreman. In doing work with this tool, the scarfing machine has been dispensed with, the tube and the safe end are taken just as they come from the cutter, and the safe end is expanded in an air machine so that it goes 3-16 of an inch on the end of the tube and is ready to weld. When at a welding heat the tube is pushed on to the stationary mandrel of the machine and the rollers are brought down. The pressure which the rollers put upon the hot tube is supplied by compressed air, which is admitted to a cylinder by a very ingenious device, which is actuated by the foot of the operator. Pressure is applied until the tube and safe end are brought down to the required thickness. The work is done so neatly that it is necessary to scrape off the scale in order to discover the weld. Any size of tube may be welded by simply changing the mandrel and rollers. For cutting tubes the rollers are taken off and disc cutters put on instead.

The machine as shown in our illustration, consists of an upright stand, J, carrying a pulley, A, and gear necessary to revolve the four rollers, F, F, around the mandrel, K. The shafts, E, E, carrying the rollers, F, are pivoted to a head, D, which revolves upon a hollow water-cooled center. These shafts pass at a slight angle through openings in the ring, M, which latter can be moved in or out parallel to the axis of the mandrel by the action of a lever which is operated by air. The ring, M, revolves with the rollers, and turns upon the water-cooled center of the machine. On account of the angle at which the roller shafts, E, E, lie, a movement of the ring, M, away from the rollers, causes them to come down on the mandrel, K, while an opposite motion of the ring forces the rollers away from the mandrel. The mandrel is pinned in place and can be easily removed when required.

The method of attaching the lever to the ring, M, is very simple. The ring has a groove turned in it all round, and in this groove slide two studs, which latter are secured to the forked ends of the lever. The attachment resembles the gimbles, which support the familiar kerosene lamp, which is such a conspicuous feature in torchlight processions at election times.

A treadle is arranged near where the operator stands, and the pressure of the foot upon this treadle opens an air valve which admits air behind the piston of a small cylinder, and this moves the lever, O. Springs are arranged to produce an opposite motion in the mechanism as soon as the pressure to the little cylinder has been cut off and the air exhausted. The Canadian Pacific officials speak very highly of the good work done by this simple, though ingenious tool.

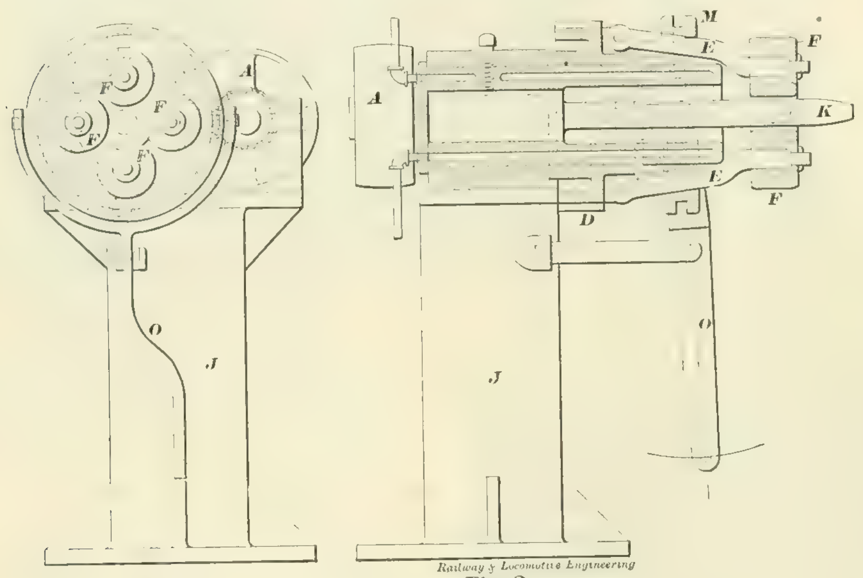


Fig. 1 *Fig. 2*

BYRD'S FLUE WELDER.

The streets of the city of Madison, Wis., are being illuminated with Nernst lamps. Some of the business men in one of the blocks on East Main street put in five of these lamps independent of the city arc lights at each end of the block, making that section of the city a blaze of electric lights. The absence of flicker in the Nernst lamp, and the fact that it casts no shadow on the street make it especially adaptable for outdoor lighting, and the occupants of the adjoining block to the west were not slow in seeing the benefits of having their block better illuminated, and also made arrangements for five of the lights. The movement is spreading and it is highly probable that the other blocks in this vicinity will adopt the same plan and that finally the capitol will be encircled with these celebrated little street lamps.

Favors American Locomotives.

The rabid engineering Anglomaniacs who can see no merit about machinery made outside of Great Britain, and particularly of locomotives, will be badly shocked over the report sent in by Sir George Whitehouse, manager and chief engineer of the Uganda Railroad of Africa. The report says:

"We have thirty-six American and thirty-four British main line engines. The experiment with the American locomotives proved entirely satisfactory. They are 10 per cent. cheaper, and although their finish is not so perfect they are more suitable for a mountain railway, like the Uganda road, because they are not so rigid and take the curves more easily.

"Of the steel viaducts along the line twenty-six are of American and eight are of English make. The American viaducts are excellent, but the contractors were greatly behind time, and took a year instead of seven months to erect them."

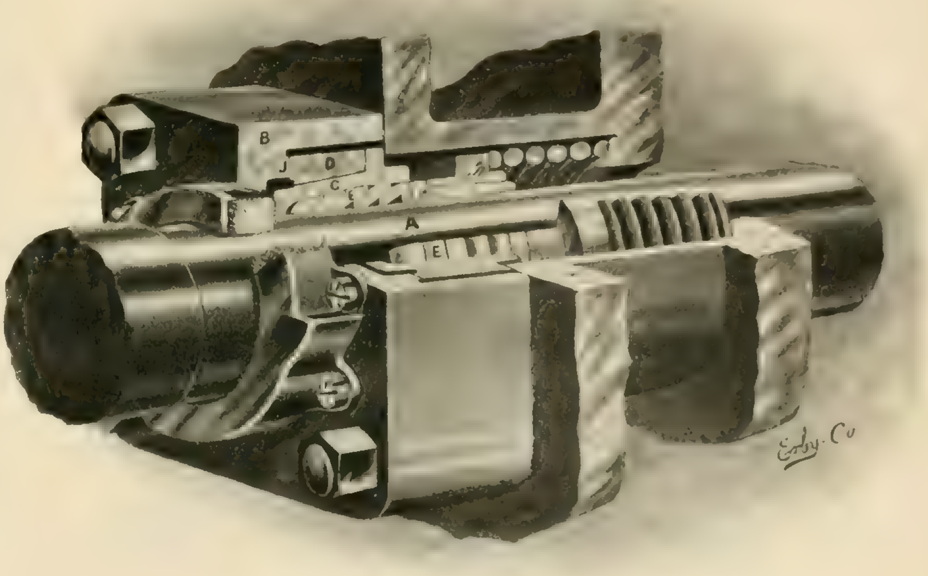
The erecting of first class bridges is always a difficult matter in the wilderness, but it seems to have been particularly difficult in Africa. Sir George Whitehouse mentions that the difficulties of bridge construction were badly increased by the presence of lions along the route. It is said that these savage brutes carried off no less than twenty-seven employees. None of them returned.

Congress Hall, the very handsome hotel at Saratoga which has been closed for several years, will be open for the Master Car Builders' and Master Mechanics' convention in June. The proprietor offers the rate of $3.50 and upwards, $4.50, each for rooms with bath. Congress Hall was the first headquarters of these conventions in Saratoga. When the joint committee of the two associations first decided to go to Saratoga, they selected the Grand Union Hotel for headquarters, but when the committee of arrangements went to make arrangements they were very frigidly received by the proprietors and plain intimation was given them that the hotel did not want any conventions of that kind. The committee then went to Col. Clement, who was manager of the Congress Hall, and received the very best kind of treatment.

The Kingston Locomotive Works of Canada are importing machinists from Great Britain. There is no contract labor law in Canada.

New Jerome Packing.

"Circumstances alter cases," is true in general, but it is particularly true concerning the new Jerome packing which has lately been devised by Jerome & Elliott, of 35 South Canal street, Chicago. The increasing use of piston rods, with enlarged ends in the crosshead fit, and the higher boiler pressures carried nowadays, has made it necessary to get out a new design for cone and follower, which can be used with the standard Jerome rings. The new cone and follower are each made in two pieces, divided horizontally so that they may pass over the enlarged end of the piston rod when being applied. These pieces are fitted with dowel pins to hold them in place after they are put on the rod. The cone marked C in the cut is provided with a collar, which prevents the retaining ring, D, being driven on hard enough to burst it. Without this collar the heavy cylinder pressures used in starting, would force the retaining ring on so hard that it could not easily be removed in case of repairs, or the cone itself might be crushed. The illustration shows the arrangement of the various parts, in which A is the piston rod, showing enlarged crosshead fit. B is the gland proper, C is the cone made in halves, D is the cast iron retaining ring, with ground joint at J. The standard Jerome metallic packing rings are shown at E, and the follower, F, also made in halves, is held in place by the retaining ring, G. The spring is marked H in the cut. The new style of swab holder, which is also made in halves, is arranged to admit oil through three openings, two in the sides and one on top, thus insuring perfect lubrication to all parts of the rod.



JEROME & ELLIOTT METALLIC PACKING FOR ENLARGED END PISTON RODS.

New Pedrick & Ayer Shop.

The well-known Pedrick & Ayer Co. is one of the many concerns forced by the growth of their business to seek more commodious quarters. For several years this company occupied its own factory in Philadelphia, extending its rapidly growing line of air tools, while continuing its older line of special railroad tools and appliances for which the company gained its reputation.

A site for the new modern works was purchased adjoining the Clinton avenue station of the Central R. R. of New Jersey, at Plainfield, N. J. No expense has been spared in the construction and equipment of the buildings, which are all of brick and steel.

The main building contains the offices of the company, draughting room, tool room and storage of principal raw materials and finished parts. The principal portion, however, is occupied by the machine shop proper, the fitting, assembling, testing and shipping departments. The main bay is provided with a 15-ton Shaw electric crane, equipped with three motors. Besides the main traveling crane there are numerous hoists and Jib cranes actuated by compressed air. The machine tools are all driven by electric motors. In the testing department proper arrangements are made to provide practical working conditions for the air compressors. Portable and stationary riveters, hoists and cranes, which are produced in great variety and size.

The boiler and engine house, with fire wall and metal door between, may be considered as one building. The boiler room is well equipped with all necessary appliances required by modern usage and has substantial storage capacity for coal. The engine-room contains a belted automatic air compressor of the type largely sold by the company, and two direct-connected dynamo-engine sets for supplying power and light to the entire works. The sets are 150 kilowatts capacity each, the engines furnished by the Ames Iron Works and dynamos and switch-boards by the General Electric Co. The blacksmith shop and pattern shop and storage house are equally well provided with the accessories for good reliable, up-to-date work. The entire plant reflects credit upon the enterprise of the Pedrick & Ayer Company. They have sufficient capacity to develop improvements for which the buying public is always ready.

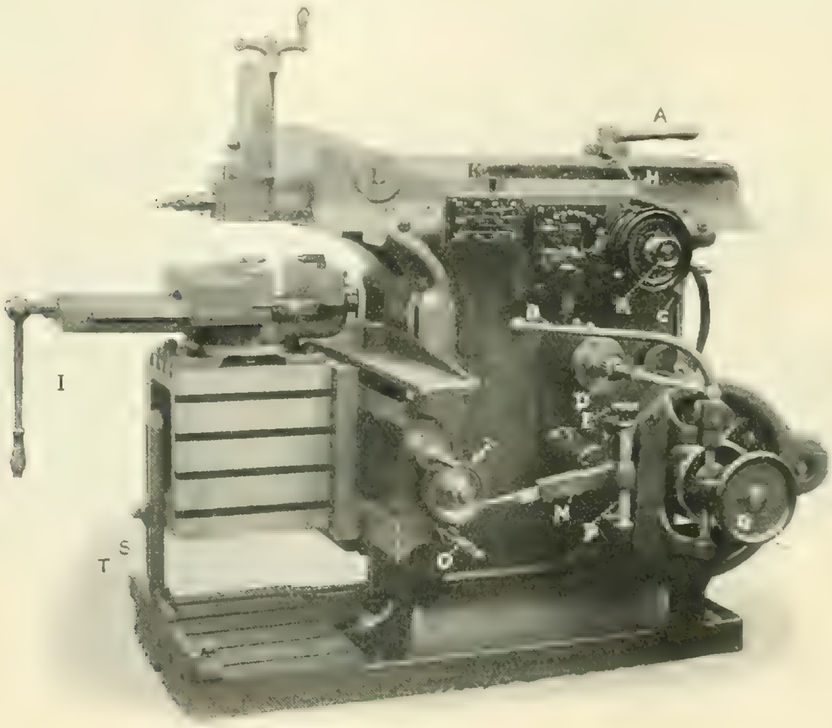
Manchuria as Our American Market.

American manufacturers are directly interested in the attempt that Russia is making to take possession of that Chinese province. A correspondent of the Washington *Post* says: The principal American imports into Manchuria are cotton manufactures, oil and flour. The Russians have imported railroad material, rolling stock, machinery and like articles. In ten years our trade grew almost 200 per cent., and it is steadily increasing. Count Cassini has assured Secretary Hay that there will be no discrimination against American goods and American industrial enterprise. Secretary Hay sought to have China open two more ports in Manchuria, which would benefit not only American, but international trade generally, in this observing the principle of the "open door." Russia has based her objection upon the fact that foreign concessions will be established at those ports, which will become scenes of political intrigue, and she wants no political intrigues in territory which Great Britain and Germany, as well as other nations, have recognized as comprising her sphere of influence.

The National Malleable Castings Company, of Cleveland, Ohio, have lately put upon the market the National Malleable iron brake-jaw and dead lever guide, which were illustrated in our April issue. Both of these devices have been patented by the company. It will be remembered that the principal feature, common to both, is the method of attaching the rod. There is no welding, the jaw is slipped onto the rod through one of the two parallel holes in the end of the casting, then the end of the rod is bent over a mandrel and is made into the form of a pot hook, and is then slipped through the other parallel hole. The end is then slightly bent over so as to prevent the jaw slipping back, and the thing is done. The dead lever guide is similarly fastened.

A Modern "High Duty" Shaper.

The "new machine shop practice," including the modern betterments of thorough factory organization, the use of the new "high duty" tool steels, and the accurate recording of successive similar operation time expenditures, is said in a certain instance to have reduced the per pound finishing labor costs as much as 30 per cent., although the shop in which this very large gain was made was at the start a thoroughly well-equipped establishment. A considerable proportion of this gain came from the introduction of the new steels for cutting tools, intelligently used in connection with improved speed-changing devices applied to the machine tools themselves, whereby the workman was enabled to very quickly change the cutting speeds, and so secure the fullest possibilities from the great endurance of the high duty cutting steels.



GOULD & EBERHARDT SHAPER.

The shaper has been allowed, by most builders of machine tools, to remain in nearly the same general form and possessed of the same metal-removing powers, for a long period of time, during which some improvements were made in the way of certainty of measurement in tool setting, but no very great advance in quickness of handling or range of cutting speeds. Recently Gould & Eberhardt, of Newark, N. J., have made a series of shaper improvements, involving almost every detail in tools of this class, and finally resulting in the perfected electric-motor-driven "double triple quick" stroke shaper shown in the accompanying illustration. It has great flexibility of drive, and a most convenient series of speed-change producing devices. Gould & Eberhardt advocate individual motor application to machine tool driving, claiming that it has decided advantages over the grouping of several machines and driving them with one motor. As a strong argument in favor of their advocacy of the single motor drive, they cite their new shaper, the arrangement of which permits of the speed being instantly changed to suit the metal being worked, which would not be possible if the machine were one of a group, where any change in the speed of one would affect all of the machines in the group.

The variable speed motor is started by the knife switch *K*, and its speed is controlled by the rheostat knob *R* and by the back-gear change obtained through the lever *C*. All of the ram stroke variations, from 100 strokes per minute single geared, to five strokes back geared, can be made inside of 10 seconds, actual time, thus making it possible to economically vary the tool speed, to suit the best working conditions for performing short operations, as must be done to obtain the lowest possible labor costs of part-finishing with the new tool steels. The hand wheel *G*, on the outer end of the pinion shaft, gives a very convenient hand movement of the ram, either way, as may be desired by the workman in setting the tool. All shafts run in cylindrical bushes held in bored seats in the frame, and can be cheaply renewed without change of original alignment. The pillar is ribbed inside, and the whole machine has all the metal everywhere that can be used to advantage for solidity and stiffness.

Messrs. Gould & Eberhardt are just putting through an order for fourteen of their new 24-26-inch Extension Base Shapers, for one of the largest railroad companies in this country, which will be used in their repair shops.

Water Purifier and Feed Water Heater.

The Centrifugal Feed Water Separator and Purifier Company, of 21 Quincy street, Chicago, have recently placed upon the market a machine which is the invention of Mr. E. P. Caldwell. It has for its object the purification and heating of feed water. It consists of three cylinders grouped together as closely as possible so as to take up minimum space. The feed water is passed into what is called an "intensifier," where it goes through a series of steam-surrounded tubes, down one side of the chamber and up the other. In this chamber it is brought to a temperature of between 275 and 300 degrees F. The high temperature precipitates the soluble substances in the water, and there is a sediment collector at the bottom of the chamber. The feed water then enters the second chamber, where it is mechanically agitated and allowed to cool somewhat, more sediment, therefore, falls to the bottom in this chamber and is collected and blown off from time to time. The cool feed water is now introduced into a second "intensifier" and passes down one series of tubes and up another, and from there it is ready to be supplied to the boiler at a temperature of from 285 to 300 degrees F. A sediment collector is also placed at the bottom of this vessel where scale-producing matter, if any then remains, is collected and drawn off. The company also manufacture this apparatus in very compact form, consisting of one cylinder for use on locomotives. They will be happy to answer any inquiries and to send a copy of their pamphlet on the subject to any persons who are interested enough to apply to them for it. An analysis of feed water used at the Ewart Building, Chicago, was made by R. W. Hunt & Co., and shows very satisfactory results from the use of this purifier.

The Manchester Locomotive Works long ago carried on a lucrative business in the building of the Amoskeag fire engine, which was famous for its efficiency in extinguishing fires. Since the American Locomotive Company obtained control of the Manchester Locomotive Works, the building of fire engines has fallen into disrepute. As all the accommodation of the works is more than needed for the construction of locomotives, the owners are disposed to sell their interests in building fire engines and rumors are current that a sale has been effected.

Hollow Car Axles for Heavy Freight Service.

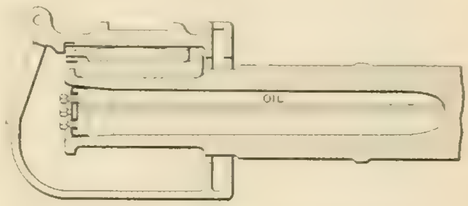
Some very successful work has been done at the Homestead mills of the Carnegie Steel Company in the preparation of hollow steel axles for freight car service. The method pursued has recently been set forth in a paper read by Mr. Camille Mercader, of Pittsburg, before the British Iron and Steel Institute.

The work may be briefly described as follows: A rolled, round steel blank, as it is called, is uniformly heated and placed in a two-part die which has its cavity in the form of a rough turned axle. The blank being as nearly as possible cylindrical is smaller than the cavity of the die. When in place, this blank axle is clamped in the center and punched simultaneously from each end by two water-cooled high carbon Bessemer steel punches made slightly taper and pointed with drop forged steel caps made in the form of a parabola, like the reflector of a locomotive headlight. These caps are made slightly larger in diameter than the body of the punch in order to reduce friction, when going in, and the barrel of the punch is coated with black lead for the same reason.

The punch entering the hot steel blank squarely in the center, encounters equal pressures all round and so has no tendency to deviate, but produces a deep perforation which coincides exactly with the axis of the axle. As the punch goes into the hot metal of the axle, the latter is forced out, into the cavity of the die and so takes a sharp impression and comes out in the shape of a rough-turned axle. In order that there may be no abrupt change from the hollow to the solid form, toward the center of the axle, the cap of the punch is left in the axle as the barrel is withdrawn. It is made, as already mentioned, in the form of a parabolic curve, which is the best form which can be used to "shade off," if one may so say, from hollow to solid metal.

The advantages which this form of axle is believed to possess are that it combines minimum weight with maximum strength. The hollow axle would, however, have to be slightly larger in diameter at the ends than the solid axle to give the same strength. The forging of these axles being carried out externally and internally, the material is more homogeneous, and much more dense, and any danger of segregation is removed. Being strongly compressed the journals can be finished with a high degree of polish, thus tending to reduce friction. The hollow journal will not heat as readily as a solid one and the cavity in the center may become an oil reservoir, and when appropriately plugged will permit only the amount of oil to leak out which is required for perfect lubrication. The forcing of the axle tightly into the matrix of the die insures a perfectly straight and true axle which does not have to be straightened after punching. The ends do not have to be cut, as the back end of the rams, when punching, compress the axle to the exact length, and upset the outer journal collars at the same time.

Three times the number of axles can be punched and so made from blanks into practically rough-turned axles with a given number of men as the same number of men could forge under a hammer, thus producing a corresponding saving in fuel and steam. The process of punching develops any hidden defects in the steel, and by exposing them in the process of manufacture, most satisfactorily anticipates failure on the road. The uniform taper toward the center both ways between the wheel seats produced by this process of pressing, insures more uniform fiber stresses throughout the body of the axle. The fact that the solid central portion of the axle is not so dense as the journal and wheel-seat portions, facilitates the transmission and absorption of shocks and vibrations due to service. The skin of the steel is



HOLLOW AXLE SHOWING OIL RESERVOIR.

only cut on the journals and wheel seats, rough turning of the center being unnecessary, and the whole of the internal skin of the cavity remains unbroken. A saving of 33 per cent. in steel is expected and the possibility of supplying perfectly uniform axles of minimum sizes and weights, is relied upon to thus secure less dead weight for the car under which they are used.

This system opens up the pleasing prospect of re-working old axles, worn below the limit, and of giving to them a new lease of useful life, just as the re-rolling of worn rails does to that kind of track material. The processes in each case are like Aladin, of Arabian Nights fame, who went about offering new lamps for old. The Bessemer & Lake Erie railroad are experimenting with a number of these hollow axles, under cars in heavy freight service.

Nebraska was visited on May 2 with a snowstorm that was so severe that passenger trains were blocked in several places and much suffering resulted among people and stock.

The dog that snapt the shadow dropt the bone.—*Tennyson.*

Change in Meeting Place of Railroad Mechanical Conventions.

The railroad mechanical conventions meet this year at Saratoga under difficult circumstances. When the joint committee of the two associations met last December to decide upon a place of meeting, representatives of hotels from four or five places were present and made offers of accommodation that seemed satisfactory. There was a desire to meet the wishes of western members by the selection of a western place of meeting, and the Grand Hotel Mackinac was chosen. A Mr. Ritchie, representing that hotel, was present at the Joint Committee meeting, and engaged to supply all the accommodation required for fifteen hundred guests, and even went to the extent of saying that they could accommodate twenty-five hundred people if necessary. When the time of meeting approached near enough for applications for rooms to be sent in, the proprietors of the hotel discovered that they did not have rooms enough to supply more than half the applicants, so they declined at the eleventh hour to have anything to do with the conventions. When this decision was arrived at the Joint Committee met without loss of time and decided that the conventions should be held at Saratoga, where they were certain sufficient accommodations would be provided. This required that the meetings should be postponed one week, so they will not meet until Wednesday, June 24, when the Railway Master Mechanics' Association will begin their sessions. The Master Car Builders will meet on the following Monday.

The Armstrong Cutting-Off Machine.

In the manufacture of tool holders it is often necessary to cut off large quantities of self-hardening steel into cutter lengths. This class of steel gives most satisfaction when cut off cold. The ordinary shop practice has been to cut the steel off hot or to break it off on an anvil. The objection to the latter method is that the break is liable to be very irregular, resulting not only in a loss of steel, but also in increased grinding, with attendant waste of time and wear of emery wheels. After experimenting with various methods of doing this work, the Armstrong Brothers Tool Company have developed the machine here illustrated, which in a slightly different form has been in practical use in their works for about two years. A patent has been applied for.

The cutting is done by a disc of special grade tool steel revolving at high speed. Any attempt to cut soft steel or ordinary cast steel with a disc results in a rough dragging cut, with flaring lips, which bind the disc to such an extent as to reduce its speed to a point where it is ineffective, if it does not actually stop or break the disc. Owing to the peculiar nature of self-hardening steel, however, it is not affected in this manner by the cutting disc, which makes in it, even when forced hard, a clean, clear-cut incision. The periphery of the disc is coated with self-hardening steel particles, and these particles do the cutting.

Its convenience and economy make it a paying investment in any machine shop, especially to those which are using the Armstrong Tool Holders. The machine is of combination form, the steel cutting disc being mounted on one end of the spindle, while the other end of the spindle carries a 12-inch grinding disc. The speed at which the machine is intended to run is such as to give the very best results for both operations. The spindle is of tool steel ground true. Bearings are cast iron and are dust-proof, with convenient and positive adjustment for wear. The swinging table

ARMSTRONG CUTTING-OFF MACHINE.

is provided with a length gauge, and is conveniently adjustable for steel of different sizes or depth of cut. The cutting disc is provided with a neat guard, which can easily be swung back out of the way when changing the disc.

The grinding disc is made of boiler plate, and is provided with an adjustable table, so located that the operator will not interfere with cutting off long bars of steel.

Each machine is equipped with counter shaft, one cutting disc, one grinding disc, one breaking block, one press for emery discs, one dozen emery cloth discs assorted, one pound lubricating grease and one can special cement for attaching emery cloth to grinding disc.

The J. A. Fay & Egan Co., manufacturers of woodworking machinery, have just issued a neat little pamphlet entitled, Instruction on the Erection and Care of Band Saw Mills, Band Bosses, Hand Saws, etc. The book is dedicated to the sawyers of the world. Upon request this useful little book, which is fully illustrated, will be sent free of charge to any sawyer or other person interested, by the J. A. Fay & Egan Co., of 445 West Front street, Cincinnati, O.

The Lunkenheimer Company, Cincinnati, report that on account of the unprecedented demand for their superior line of brass and iron steam specialties, they have been compelled to increase their foundry output 50 per cent. Machine tools of the most improved type are being installed in various departments as fast as they can be obtained.

Three hundred employees of the Lima Locomotive and Machine Company went on strike last month because the company sought to put machinists and moulders on piece-work basis. The strikers demanded that they be given straight day work, and that M. Coakley, of Chicago, the newly installed superintendent, be removed. The dispute was settled by the company yielding to the demands of their employees.

There have been a tremendous number of new locomotives built for railroad companies during the past three years, but the increase in numbers does not by any means represent the increase of power. The rule now is with all roads to increase the engine capacity, and with many to reduce the number of engines. As shown by the annual report of the Union Pacific that road reduced its number of engines during the fiscal year ended June 30, 1902, about 5 1-2 per cent, and at the same time increased its aggregate motive power by 9 1-2 per cent.

The Rand Drill Company, through their pneumatic tool department, report the recent sales of many large complete air plants, including their new "Imperial" Pneumatic Hammers and Piston Air Drills. Plans are now being drawn for an extensive enlargment of the Rand Drill Company works to meet these increased demands.

The White Mountain Paper Company has recently purchased from the Westinghouse Electric & Manufacturing Company three 1,000-kilowatt and one 300-kilowatt, three-phase, engine-type alternators, which are complete with exciters and are to be direct connected to Hamilton-Corliss engines installed in its paper mill at Portsmouth, N. H. The various machines in this mill will be operated by Westinghouse, type "C" induction motors, aggregating 5,500 horse power. When this apparatus is in operation it will comprise the largest individual electrical installation in a paper mill in the world.

QUESTIONS ANSWERED.

(37) G. R., Tweed, Ont., asks us to please explain (1) why a short stack should interfere with an engine steaming. The engine referred to was a good steamer, but when going through the shop had about a foot taken off top of stack. A.—In the matter of draft, the volume of smoke-box gases which are ejected at each exhaust is important. Exhaust steam does no useful work when it has passed out of the stack, the greater volume of gas it can draw with it as it goes up the stack, the more powerful will be the draught. Suppose we say that each exhaust expels a stack full of hot gas, it is apparent that the shorter the stack, the less the amount of gas which will be thrown out. The Grand Trunk Railway of Canada use long stacks of small diameter, and believes that it enables them to use large nozzles. (2) Please explain why an engine crowds over to, say, the left side, and cuts flange on that side. A.—The engine is probably not quite "square."

(38) W. W. P., Newark, Ohio, asks, if there is any ready method of finding how many gallons of water are in tank for every inch in depth, so that an engineer can readily compute water consumption. A.—There is no ready method such as you speak of; the cross-section of very many tanks now used varies with the height on account of the sloping of the sheets in the fuel space, which is done so that the coal as used will keep working down to the fireman. If the tank had a constant cross section such as the old U-shaped ones with straight sides, it would be easy to calculate what a layer of water one inch deep amounted to, but the calculation would only hold good for that particular tank and others exactly like it. A gallon of water, U. S. measure, contains 231 cubic inches.

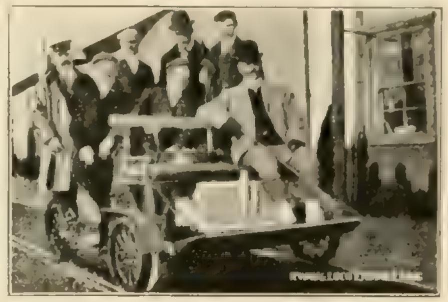
(39) W. S. M. writes:

If you have a standard tram for your driving-wheel centers, say for a mogul engine, and you lay off shoes and wedges from these tram points, put wheels under engine and she trams all right all round, and you have solid side rods with new brasses in all round. You tram your rods and find one or two $\frac{1}{8}$ in. too long and another $\frac{3}{16}$ in. too short. What would be the proper thing to do, with solid end rods? A.—The proper thing to do would be to have the rods altered to the proper length in each case.

(40) A. B., Newark, N. J., writes:

(1) Will you kindly advise me how a two-cylinder compound engine should be counterbalanced? Should the low-pressure side be balanced according to the weights on that side, and the high-pressure side according to its weights, using the M. M. rules in both cases? A.—Each side should be balanced for itself alone, using M. M. rules. (2) Have you ever printed an article on the Davis counterbalance? A.—We illustrated an engine having the Davis counterbalance in the December, 1902, issue, page 523. The engine is used on the Big Four.

(41) J. J. T., Philadelphia, asks in what way does the air valve to the blow-off cock work, and suppose that I turned the valve and opened the blow-off cock and turned the valve back to shut it off and found it did not close blow off, and that I could not turn regular valve wheel. What could I do? A.—Air enters above a piston and moves it down, the stem of the piston unseats the valve. When you shut off air the valve should close. When operated by hand the nut should be screwed upward and partly out of the valve case, and the action of a spiral spring inside is supposed to close the valve. Screwing the nut further out should draw the valve shut. If it is stuck open after everything has been done to close it, as your question suggests, then the valve probably requires overhauling.



TRACK INSPECTION CAR.

Railway Motor Car.

The photograph here reproduced shows a new petrol-driven railway inspection car which has just been constructed for the London & South-Western Railway Company by Mr. Robert W. A. Brewer, A.M.I.M.E., etc., of Westminster. So successful has this car proved and so satisfied with its performances is Mr. Grainger (of the London & South-Western Railway Company) that the London, Brighton & South Coast Railway Company have ordered a similar vehicle. The following description of the car has been furnished by Mr. Brewer:

The car is very simple in its construction. There are no springs, the axles running in brasses bolted on the front of the car. The cylinders are outside the frames; the valves are all vertical and all mechanically operated. The lever which throws the electric ignition in gear also holds open the exhaust valve in its "off" position, so that when running down a bank there is no compression, the ignition, of course, being out of gear. The carbureter is fitted below the petrol feed tank (which holds 2 gallons), and the quantity for each charge is regulated by a needle valve, the lever of which works

over a graduated scale on the feed tank. There is storage provided for extra petrol, but the car is said to run nearly one hundred miles on two gallons. The engine, of course, is of slow speed—maximum about 500 revolutions per minute—the wheel being 20 in. in diameter. The engraving and description are taken from *The Car*, London.

Cleveland Pneumatic Hammers.

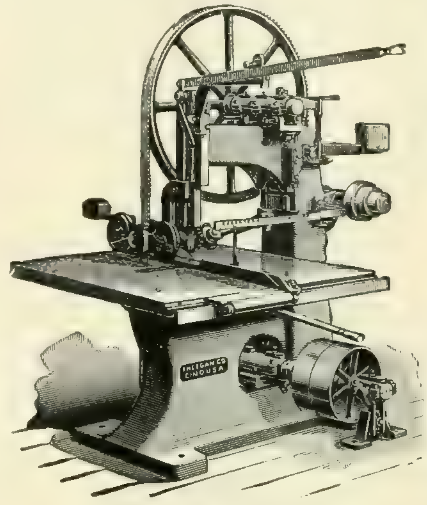
Catalogue E, of the Cleveland Pneumatic Company, is a very attractive publication. It has just been issued from the office of the company at the corner of Hawthorne and Second avenue, Cleveland, Ohio. This publication, of 58 pages, shows the tools made by this company in beautifully clear half-tones, which are printed on heavy cream paper, the letter press on the side giving full information as to size, weight, speed, etc. A sectional line cut numbered and named affords a convenient reference page for ordering parts. There are a number of engravings showing the tools in use, chipping a steel die, chipping structural work and chipping gray iron in the foundry. Beading flues in the boiler shop, or caulking a seam. The long stroke riveting hammers are illustrated and fully described. A sectional view for ordering parts is also given. A series of pictures of the long stroke hammer show it "going up against" structural work, tank work and bridge work. The German Kaiser's yacht *Meteor*, having been riveted up with these hammers, is displayed "under full press of canvas," and the Twentieth Century train on the Lake Shore is shown and quoted as the standard of excellence which is maintained in the manufacture of these tools. The catalogue is exceedingly well got up, and is most interesting, as it shows the pneumatic holder-on, the painting machines and the air hoists, and gives actual scenes from workshop and factory, with all these tools in actual use. Send to the company in Cleveland and have a look at it yourself.

New Band Rip Saw.

If any of our readers have any ripping to do, the machine here represented will without doubt prove of much interest. Its makers claim it will surpass in quality and quantity anything in this line they are now using. For ripping fine lumber it is far in advance of other models, and represents an entirely original design.

It will do either light or heavy work, and will cut either soft or hard wood, with no possible danger to the operator. Its many advantages which enable it to do good work and prove itself a labor saver require detailed description, so cuts should be asked for in order to thoroughly understand what it can do. The thin saw blade will shave an amount of kerf that will be readily appreciated by all users of fine lumber. The straining device, with knife-edge balance, insures at all times an even tension on the saw blade, something very necessary to prolong its life, and yet so seldom found.

The lower wheel being solid, there is no vibration, increased momentum, and no possibility of it overrunning the upper. By the single movement of a lever the machine is converted into a hand feed rip saw, and where flooring is made in large quantities, it is fitted with a long table on which are rolls for quickly returning material. The feed rolls are placed close together, so that short work can be done to advantage.



NEW BAND RIP SAW.

The builders of this tool, J. A. Fay & Egan Co., Front street, Cincinnati, Ohio, can be addressed for further particulars. Their new complete catalogue of wood working machinery will be sent free to those interested who write for it, mentioning this paper.

The Book-Worm.

The book-worm is described in the dictionary as a ptinid beetle, and that rather odd word comes from a Greek root, which means to destroy. This little insect is fond of hiding away among the leaves of books, and in time destroying the paper. Now it must be remembered that this little destroying insect does not eat its way into a book very fast, so that books which are constantly in use or are even kept clean do not suffer from the inroads of the beetle. The book-worm's home is the unused library where old books, treating of dry, uninteresting subjects lie upon shelves covered with cobwebs and dust. Modern works upon engineering and scientific subjects are not likely to become food for the book-worm for a long time to come by reason of the fact that those people who possess them, read them, and having read them, refer to them time after time. If there is anything a book-worm hates, it is

trying to settle down in a book which is constantly taken from the shelf and put back again. Cast your eye over the list of books which follow, and see if any of them, in your opinion, would likely be left on the shelf by an owner who was in active railway work. Do you think any of these volumes would ever become a prey for the book-worm?

The first on the list is, of course, RAILWAY AND LOCOMOTIVE ENGINEERING, a practical journal of railway motive power and rolling stock. It costs only $2.00 a year, and is well worth the money, and besides the paper is a welcome visitor in every household and its popularity with children is astonishing.

"Locomotive Engine Running and Management," by Angus Sinclair, is an old and universal favorite. A well-known general manager remarked in a meeting of railroad men lately, "I attribute much of my success in life to the inspiration of that book. It was my pocket companion for years." We sell it for $2.00.

"Practical Shop Talks." Colvin. This is a very helpful book, combining instruction with amusement. It is a particularly useful book to the young mechanic. It has a stimulating effect in inducing him to study his business. Price, 50 cents.

"Examination Questions for Promotion." Thompson. This book is used by many master mechanics and traveling engineers in the examination of firemen for promotion and of engineers likely to be hired. It contains in small compass a large amount of information about the locomotive. Convenient pocket size. We cordially recommend this book. Price, 75 cents.

"Compound Locomotives." Colvin. This book will instruct a man so that he will understand the construction and operation of a compound locomotive as well as he now understands a simple engine. Tells all about running, about breakdowns and repairs. Convenient pocket size, bound in leather, $1.00.

"Catechism of the Steam Plant." Hemenway. Contains information that will enable a man to take out a license to run a stationary engine. Tells about boilers, heating surface, horsepower, condensers, feed water heaters, air pumps, engines, strength of boilers, testing boiler performances, etc., etc. This is only a partial list of its contents. It is in the question and answer style. 128 pages. Pocket size. Price, 50 cents.

"Care and Management of Locomotive Boilers." Raps. This is a book that ought to be in the hands of every person who is in any way interested in keeping boilers in safe working order. Written by a forman boilermaker. Also contains several chapters on oil-burning locomotives. 50 cents.

"Locomotive Link Motion." Halsey. Any person who gives a little study to

this book ceases to find link motion a puzzle. Explains about valves and valve motion in plain language, easily understood. $1.00.

"Machine Shop Arithmetic." Colvin and Cheney. This is a book that no person engaged in mechanical occupations can afford to do without. Enables any workman to figure out all the shop and machine problems which are so puzzling for want of a little knowledge. 25 cents.

"Firing Locomotives." Sinclair. Treats in an easy way the principles of combustion. While treating on the chemistry of heat and combustion is easily understood by every intelligent fireman. 50 cents.

"Air-Brake Catechism." Conger. Nothing better can be found for persons trying to learn all about air brakes. Tells the whole story. Cloth, 75 cents. Leather, $1.00.

"Skeevers' Object Lessons." Hill. A collection of the famous object lesson stories which appeared in this paper several years ago. They are interesting, laughable and best of all they are of practical value to-day. $1.00.

"Stories of the Railroad." Hill. Best railroad stories ever written. Those who have not read these stories have missed a great literary treat. $1.50.

"Block and Interlocking Signals." Elliott. Tells what signals are, what they do and how they do it. Comprehensive treatise on the subject. Ought to be studied by all trainmen where block signals are used. $3.00.

"Standard Train Rules." This is the code of Train Rules prepared by the American Railway Association, for the operating of all trains on single or double track. Used by nearly all railroads. Study of this book would prevent many collisions. Price, 50 cents.

"Mechanical Engineers' Pocket Book." Kent. This book contains 1,100 pages 6x3¼ inches of closely-printed minion type, containing mechanical engineering matter. It ought to be in the book case of every engineer who takes an interest in engineering questions. We use it constantly as a reference for questions sent to us to be answered. Full of tables and illustrations. Morocco leather. $5.00.

"Locomotives, Simple, Compound and Electric." Reagan. An excellent book for people interested in any kind of locomotive. It will be found particularly useful to men handling or repairing compound locomotives. It is the real locomotive up to date. $2.50.

RAILWAY AND LOCOMOTIVE ENGINEERING. Bound volumes. $3.00.

Looking at Things and Not Seeing Them.

Some time ago we advised any of our friends who wished to test their powers of observation to do the Sherlock

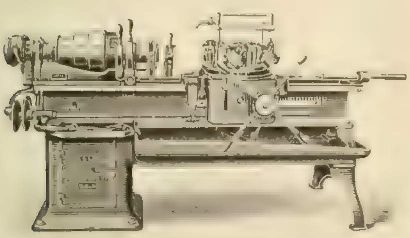
Holmes act on a certain class of moving pictures which are nightly produced by the Kalatechnoscope at any of the F. F. Proctor's theaters in New York, Newark, Albany or Montreal. The class of pictures to which we referred are those where a hansom cab or a fire engine or any wheeled vehicle is driven rapidly along a public highway. With such pictures the curious optical illusion is sometimes presented of a carriage bowling along, say in a southward direction, with the wheels apparently turning slowly as if the vehicle was moving north.

In a former issue we gave the reason for this appearance, and showed that the moving picture was in reality a series of separate and motionless poses photographed on a celluloid film and drawn rapidly past an illuminating and obscuring mechanism and flashed upon a white screen.

Not long ago a friend of ours said to us in great glee, "I have taken your advice and I went to Proctor's Fifth Avenue Theater in New York, and I am a keen observer and don't you forget it." He explained how he had seen a picture of the London fire brigade going to the scene of a conflagration, and though the horses were galloping the wheels of the machine appeared to revolve lazily backward. Now, we may here say that you cannot notice this kind of thing in the Kalatechnoscope pictures of a moving train, because the wheels revolve very fast and on an engine the connecting and side rods show the direction of motion and the swing of the counter weights heightens the reality of the scene.

We have sometimes speculated on the result of running the films of a moving picture of a fast passenger train, backward, as is so often done to produce humorous and mirth-provoking situations with human beings. If a train photographed going ahead were shown reversed it is probable that the wheels and the moving parts would show the train correctly "backing," but how many in the audience would notice the marker flags at the rear of the train fluttering briskly against the wind, or the smoke and steam flying back swiftly and very naturally over the tops of the cars, but literally in the "teeth of booming gale," and section men on the track with their hats blown off the wrong way? It would be interesting to show such a picture and then poll the audience and announce the number of real observers. Those who failed to "catch on" would certainly be among the class of people who are constantly "looking at things and not seeing them."

The Philadelphia Pneumatic Tool Company of Twenty-first street and Allegheny avenue, Philadelphia, have re-



cently got out a folder which they say is not simply "hot air." By the way, the effort of all pneumatic tool people is to use cool air all the time. This folder shows a man speaking into a telephone transmitter. The telephone wires which are here bright red lines are artistically disposed over the paper, through the reading matter, and leading to a telephone receiver where another man is listening. The wires pass round by way of a workman who is chipping out a dome space in a boiler. The inference is that he is one of the men who will soon have a new hammer. The Ironworker Company are telephoning for a dozen Keller hammers to be sent to the factory at once. In fact this firm is so very rushed that they can hardly take time to inform the Philadelphia Tool Co. what they think of the Keller hammer and the other pneumatic appliances made by this firm, but they appear to be prepared to pay for what they get and they think "money talks." The Philadelphia Tool Co. will be happy to give any information concerning Keller pneumatic tools to any one who will apply to them for it.

The L. S. Starrett Company, of Athol, Mass., have just issued a new and comprehensive catalogue of small tools made by them. The appearance of the publication is exceedingly good, and it is well printed and fully illustrated. The catalogue is No. 17, has 176 pages, and contains information concerning a number of entirely new tools, as well as new sizes and improvements in tools formerly made. The cuts of many of the tools are full size. The Starrett Company have an office in New York at 123 Liberty street, and they will be happy to send a copy of this catalogue to anyone who is sufficiently interested to apply to them for it.

The Lunkenheimer Company, of Cincinnati, O., manufacturer of brass and iron steam specialties, etc., have recently placed with the Nernst Lamp Company, of Pittsburg, a large additional order for Nernst Lamps of various sizes. The Lunkenheimer plant is now illuminated throughout by this make of lamp, it having been found superior to others in its uniform quality of light, with all sizes of units, a feature that is impossible with a mixture of arc and incandescent lamps.

The Falls Hollow Stay-bolt Co. wish to announce that trade on the celebrated Falls Hollow Iron is rapidly increasing and their stay-bolt material has been specified in many recent large orders for new locomotive equipment. They continue to manufacture solid iron, made of the same high grade of double refined charcoal material, for those who want it. Falls Hollow Stay-bolt Steel has been specified by the government to be used in several contracts they let, among them, the boilers for the new Light House Tenders "Magnolia" and "Ivy," which contracts were recently placed with the Baltimore Ship Building & Dry Dock Co.

The Standard Paint Company, manufacturers of the well-known Ruberoid Roofing and the P & B products, gave a "house-warming" not long ago in celebration of the completion of their new factory at Bound Brook, N. J. From a social standpoint, the affair was a huge success. There were present some six hundred people, including the employees of the company and their friends and relatives. They danced until the small hours, being in the meantime regaled with refreshments, in an immense room some three hundred and fifty to three hundred and seventy-five feet long on the third floor of the new building.

The Standard Paint Company was organized in 1886 with Ralph L. Shainwald as president, Silas S. Packard, since deceased, vice-president, and Felix Jellinik, secretary and treasurer. Mr. Shainwald and Mr. Jellinik have continuously held their offices since. Mr. Max Drey is the present vice-president. The first factory was erected at Bound Brook, N. J., on a part of the site of the present works.

Think and speak and act like an accountable creature.—*Martin Chuzzlewit.*

CONTENTS.

Railway and Locomotive Engineering

Copyright by Angus Sinclair Co.—1903

A Practical Journal of Railway Motive Power and Rolling Stock

Vol. XVI. **174 Broadway, New York, July, 1903** **No. 7**

Atlantic Type Engine in Germany.

In sending us particulars of the German compound reproduced here, Mr. M. Richter says:

The Atlantic, or 4-4-2 type of engine, was introduced into Germany in 1898, and for the same reason that it became popular here, viz.: the necessary enlargement of the boiler and the increase of grate area. In the continental type, however, the pistons drive the forward axle, and for that practice it is claimed that the reciprocating parts are less heavy than they are in America, where the main drivers are usually the rear pair, and consequently the German engine has a longer wheel base and is better balanced.

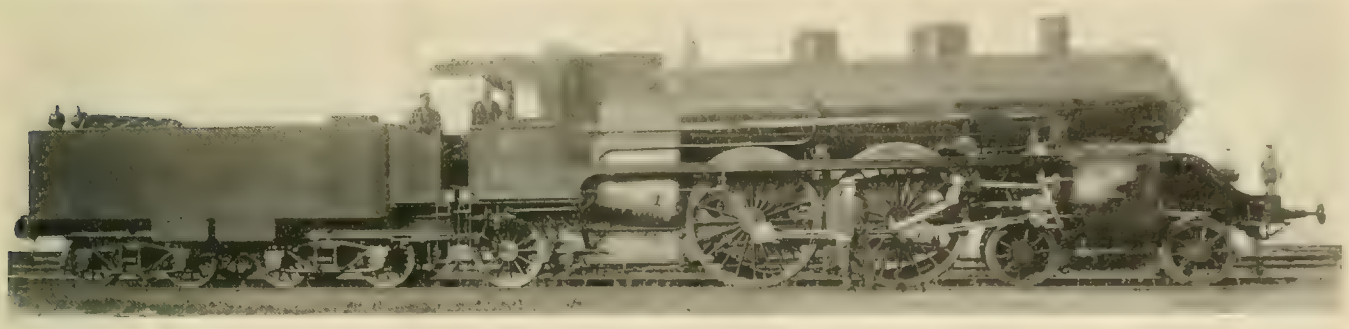
These engines were built for the Baden State railways. They were designed to haul express trains of 200 tons behind the tender at a speed of from 75 miles per hour on the level, and at 62 miles per hour on grades of 1 in 300. The cylinders are arranged with the high pressure inside and the low outside. The cylinders are 13.2 and 22.4x24.4 ins. The ratio of cylinder volumes is about 2.9. The cranks on a side are placed at 180 degrees, but are at 90 degrees with reference to the corresponding ones on the other side, so that the balancing is perfect, and the counterweights used are for the rotating parts.

The wheels are 82.7 ins. in diameter. Each side of the engine has only one valve gear placed outside the wheels and that is of the Walshaert type. A rocking shaft moves both valves, that of the high pressure, being piston with inside admission, that of the low, is a balanced side valve. In consequence of the joint arrangement of both valves, the cut-off is the same for all four cylinders, and usually amounts to 40 per cent. of the stroke. The carrying wheels have radial axle boxes.

For diminishing resistance, or in order to throw the smoke and steam high in air, the smoke box is fitted with a sharp conical cover similar to that illustrated on page 210 of the May issue. The cab front sheet is composed of two pieces, running together at an angle of 90 degrees, thus forming a kind of prow.

The boiler is straight and contains 279 tubes, 15 ft. 9 in. long and 2 in. outside diameter. The working pressure is 228 lbs. per sq. in. The smoke box is of the very extended type, being 8 ft. 2 in. long. The fire box is of the wide type, made of copper with 42 sq. ft. of grate surface; the total heating surface is 2,550 sq. ft. The safety valves are pops, which is a novelty for Europe.

The tender is carried on two trucks, and has a tank capacity of 5,300 U. S. gallons, and it carries from 6 to 11 tons of coal. All wheels on the engine and tender are braked and the total weight of the engine in working order is 74 tons with adhesive weight of 31.9 tons.



GERMAN FOUR-CYLINDER ATLANTIC TYPE COMPOUND.

With Brain and Hand.

A very interesting object lesson was given by an engineer the other day on the Lackawanna, which we, standing beside the track, had the pleasure of witnessing. A fast passenger train had just roared by and had recorded its passage by turning the home and the caution semaphores to the horizontal position on an adjacent signal post. The signals for the next block ahead were clearly visible from where we stood, and presently, as the thin wisp of steam from the engine floated on high, she entered the next block, and the signals stood instantly at danger, while the home signal close by, "cleared," leaving the caution blade still in evidence.

A moment later an engine on the same track backing a caboose, ran under the outstretched caution arm and about a hundred yards down the track the sound of the exhaust ceased. The engine had hardly drifted a train length, when the now far-away express entering another block dropped the home, behind it and nearby caution signals to "all clear." With the fall of the semaphore blades the exhaust beats pulsated again, and you could hear that little "catch in her breath" which comes when the reverse lever latch clicks near the center notch, and away went caboose and engine over a guaranteed clear line.

The whole incident was most interesting. There was the automatic mechanism—true of action but without volition, governed only by the applied laws of nature; and there was the man playing the game squarely and with skill. The signals were observed, obeyed, the throttle closed—steam on again at the very first moment after Safety said "clear." The man was working with alert mind, and quick and steady motion. The picture might have been painted for the Academy and called "With Brain and Hand."

Additional Facts About James Millholland's Work.

BY E. J. RAUCH.

Mr. Millholland built a number of engines for mountain service at the mines. The first, the "Mountaineer," had five pairs of 40-inch wheels connected with a rigid pony truck in front. Cylinders were 19x20 inches. The small wheels brought the main pin too close to the ties to look safe, and the remainder of those he built for same service had larger wheels. They did good service, but soon entailed expense on coal cars. He also built two engines to help trains on the grade between Falls of Schuylkill and Richmond. The first was the Phœnix, five pairs of wheels connected 19x20-inch cylinders—46-inch wheels. A peculiar feature of this engine was that she had two steam pumps instead of the regulation pump to supply the boiler, and fill up while standing in engine house—no injectors then. The second engine, the "Pennsylvania," had six pairs of drivers connected, 46-inch wheels. Cylinders 20x20 inches were connected to third pair of wheels from front; second and fifth pairs of wheels were blank. In a short time this engine was rebuilt and number of wheels reduced.

As a number of engines on the road had cast iron wheels and tire, as soon as the tire wore out the wheel was done for. Mr. Millholland conceived the idea of using cast iron tire on all 46-inch and smaller wheels. He had the centers made with six bosses in the fellows, through which steel pointed 1¾ set screws passed and engaged in a countersink in the tire. Centers of tires were turned and bored to templets. The tire was slipped onto its place, and the set screws drew it tight and held it. These tires seldom broke—not oftener than wrought iron—and could be changed in a very short time.

Machinist Engineers and Engineer Machinists.

It is worth notice that the very engineers that kick the hardest and ridicule the most and condemn the "machinist runner" the loudest, are the very men that think they can file rod brasses, reduce eccentric straps and line up guides better than any machinest alive. "Machinist runners" do not perform road work as well as men with road experience, and are just as poor men for engineers as "engineer machinists" are for repairs and general shop work. What both ought to do is to know what the other needs, but not how to do the other's work.

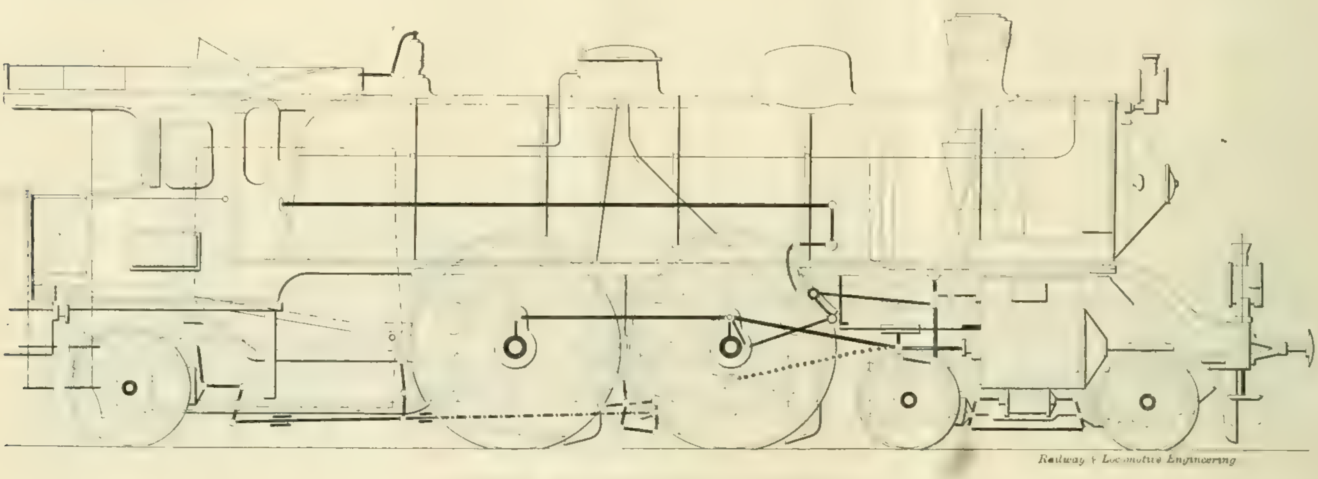
If more machinists could recognize the fact that locomotives ought to be put up so as to stand hard usage at full capacity for twenty-four hours at a stretch with the engineers caring for nothing but to use the engine to make time, and more engineers could be made to recognize the fact that the joints of a locomotive should be loose ones, that the machinists know enough to close up eccentric straps so as to be loose at the right place, and that they should be able to adjust wedges, rods and valve motion better than any engineer, the better will it be. Six weeks of firing for the aspirant of the title of "machinist runner," and six weeks as helper for the engineer who knows so much about repairs will cure the most aggravated case.

Washing a Moving Train.

A sort of a train-washed-while-you-wait apparatus is in operation on the Great Western Railway at the West London yards. It consists of a small shed built over a single track and through this a yard engine draws a train at the rate of about four miles an hour, and it comes out of the shed as clean as a good rubdown and cold water can make it.

On each side of the shed on a movable frame there are arranged brushes which are made to revolve rapidly and beside these brushes there are perforated water pipes which when the apparatus in in action, give a copious discharge of water. The whole is operated by steam power, and the men employed in the washing of cars stand behind glass screens which keep them from getting wet. By the manipulation of levers, the revolving brushes are brought against the sides of the coaches. There are water pipes on each side of the brushes, so that if by any chance the brushes should leave streaky patches the Niagara flow washes it off.

The brushes are on shafts driven by chain gear and sprocket wheels, so that water has no effect upon them, and the track is arranged to drain the water off as rapidly as it falls. Something less than a thousand coaches are thus given their 'tub" every day with thorough English regularity, and the railway company has found the washing shed to be a time and labor saver. The plant is the property of the Universal Carriage Washing Syndicate of London.



GERMAN 4-4-2 COMPOUND LOCOMOTIVE.

Some curious facts are set forth concerning trees by a writer in *Scribner's*. A single oak of good size is said to lift 123 tons of water during the months it is in leaf. This moisture is evaporated, and rises to form rain-clouds. All the trees are busy doing the same thing, and the rank ferns and mosses, and deep mould of the forest depths, acting as reservoirs for the rain which falls upon them, in their turn feed the springs and brooks. From this estimate of the labor of a single oak we can gain some idea of the immense force which the forests exert in equalizing the evaporation and precipitation and preventing periods of inundation and drought.

Heavy Consolidation for the Pittsburgh & Lake Erie.

The Pittsburgh shops of the American Locomotive Company have recently built some heavy 2-8-0 engines for the Pittsburgh & Lake Erie Railroad. These engines are simple, with cylinders 21x30 in., driving wheels 51 in. in diameter. These wheels carry a weight of 168,150 lbs. The steam pressure is 200 lbs. The maximum calculated tractive effort is about 44,100 lbs. The motion of these engines is indirect, with transmission bar curved below the second axle. The three rear driving wheels are equalized together, while the pony truck equalizes with the leading drivers. The two leading drivers have overhung springs, and the main driver and the trailer have springs placed between the frame bars to economize space. All the wheels are flanged.

HEAVY CONSOLIDATION FOR THE PITTSBURGH & LAKE ERIE.

The boiler is of the straight-top type, the smallest ring being 76 in. outside diameter. The crown sheet is level, while the roof sheet slopes toward the back about 6 in. This insures plenty of steam room. There are 370 tubes, which give 2,858.82 sq. ft. of heating surface. The total being 3,040.6 sq. ft.

The tender is of the hopper variety, and carries 14 tons of coal, the tank contains 7,000 gallons of water. The tender frames are steel channels, and the whole is carried on Fox pressed steel trucks. The tender weighs, with fuel and water, about 139,700 lbs.

A few of the important dimensions are appended for reference:

Total wgt. of eng. in working order, 189,150 lbs.; on drivers, 168,150 lbs.; driving wheel base of engine, 16 ft.; total, 24 ft. 8 in.

Height of stack above rail, 15 ft. 2⅜ in.

Cylinders, diameter and stroke, 21x30 in.

Dia. at smallest ring, outside, 76 in.; throat, 77⅝ in.; backhead, 74¾ in.

Crown sheet supported by radial stays, 1⅛ in. dia.

Staybolts, 1 in. dia., spaced 4x4 in. centers.

Dia. of tubes, 2 in.; length of tubes over tube sheets, 14 ft. 10 in.; length of fire box, inside, [illegible] in.; width of fire box, inside, [illegible] in.

Boiler pressure, 200 lbs.; grate area, [illegible] sq. ft.

Heating surface in tubes, [illegible] sq. ft.; in fire box, 181.78 sq. ft.; total, 3,040.6 sq. ft.

Dia. of driving wheels outside of tires, 51 in.; dia. and length of journals, [illegible] in.; dia. of engine truck wheels, 30 in.; dia. and length of journals, 6x10 in.

Working Up Sentiment to Favor Railroads.

A sentiment in favor of railroad building in the United States was cultivated in various ways by enterprising public men long before railroad building actually began. After a long, weary struggle in 1823 Colonel John Stevens, of Hoboken, succeeded in obtaining from the Legislature of Pennsylvania a charter for the building of a railroad from Philadelphia to Columbia. That was the first link in the great Pennsylvania Railroad.

In advocating the enterprise Col. Stevens issued a public address which makes curious reading to-day. At that time there was not a yard of railroad track in the United States and nothing in Europe except freight tramways operated by horses. Col. Stevens' address reads:

"It is now generally admitted that a railroad is not a mere visionary project, but is actually practicable. An erroneous idea has, however, prevailed among its opponents, that it is only practicable to short distances, and that the contemplated extension of a railroad to a distance of 73 miles is ridiculous.

"As the railroad will, throughout its course, be in its construction exactly similar, it is only in its deviations from a horizontal line that any difference in the progressive motion of carriages thereon can take place. The charter contains a provision that the railroad in its progress [illegible] an angle of two degrees with the plane of the horizon.

"Now let us suppose that a section of the intended railroad be constructed in the immediate vicinity of the city, of one mile in extent, in the progress of which elevations of two degrees do actually occur. Should it, however, be practicable, on such section of the intended railroad, to cause loaded carriages to move forward and backward, without encountering any impediment or difficulty, would it not be presumable that the effect would be precisely the same were a similar road to be extended ever so far? Such an experiment, then, would not fail to produce conviction in the minds of the most incredulous.

"As a further illustration of the practicability of the proposed railroad, it would be barely necessary to notice the rapid progress this important improvement has recently made in the island of Great Britain. If in the narrow limits of 21 miles in length and 12 miles in breadth, in the immediate vicinity of Newcastle, no less than 450 miles of railroad have within a very short period of time been formed, why should it not be practicable to erect one extending only 73 miles? The contemplated formation of a railroad from Manchester to Liverpool, between which large towns there now exists a spacious canal, demonstrates very forcibly its feasibility and great utility.

"The expense of the contemplated railroad is estimated at about $5,000 per mile. One thousand shares, then, at five dollars each, would be sufficient for the construction of one mile of the road.

"An appeal is now, therefore, made to the enlightened patriotism and to the enterprising spirit of the good citizens of Philadelphia to step forward, and, by an

advance of five dollars each, to place the contemplated improvement beyond all possibility of doubt or uncertainty.

"That the stock will, from the start, yield more than legal interest, there cannot be a shadow of a doubt. That it will, ultimately, and at no distant period, yield 12 per cent. per annum, is equally certain.

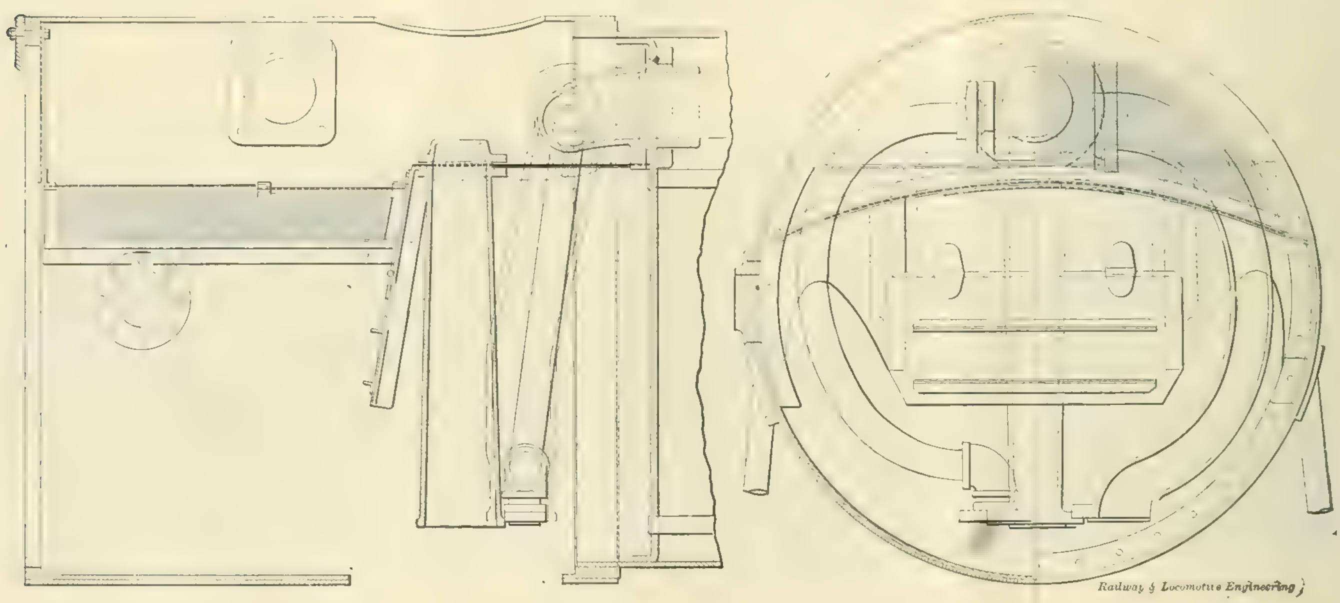
"The contemplated railroad will differ from turnpike roads in these very important particulars. The actual expense of transportation on the railroad will be reduced to one-quarter of what it now is on the existing turnpikes. But the most essential point of difference, as it regards stockholders, is that the whole of the emoluments to be derived from the transportation of commodities, and from the conveyance of passengers, will go to the railroad company, whereas the turnpike company receives only a toll. The expense of repairs will bear no proportion to that incurred on turnpike roads. The railroad, too, will be equally good at all seasons of the year. This circumstance gives to a railroad a decided superiority also over a canal, which continues, for months, during the winter season, locked up by frost.

But when, in the progress of improvement, the power of steam shall be substituted for that of horses, transportation will most assuredly be afforded at much less than on a canal. However extraordinary this opinion may appear, by a recurrence to calculation, it is, nevertheless, capable of demonstrative proof. And when this great improvement in transportation shall have been extended to Pittsburgh, and thence into the heart of the extensive and fertile State of Ohio and also to the great Western lakes. Philadelphia may then become the grand emporium of the Western country.

"Should the subscription for the shares be speedily filled the road from Philadelphia to Columbia may with ease be finished before the next winter, and thus the stockholders will derive an immediate interest on their stock."

Grand Trunk Front End.

The Grand Trunk people are using a front end arrangement which combines simplicity with effectiveness. Our illustrations show the netting in the smokebox of a crossover compound. The receiver pipes are not shown, in order that the netting arrangement may be more clearly seen.



FRONT END ARRANGEMENT—GRAND TRUNK RAILWAY SYSTEM.

The netting is put in as a rather flat arch of 8-foot radius, which goes across the smokebox and springs from the sides about 6 inches above the center line. The netting, which is cut to suit the receiver pipe, is carried back to the deflector plate, which is just in front of the exhaust pipe.

The deflector plate is carried up a few inches above the highest point of the netting arch, and runs straight across the smokebox. In fact the deflector plate is placed at the level of the joint between exhaust pipe and exhaust nozzle. From the deflector plate to the flue sheet a solid No. 10, B. W. G. steel plate cuts off the space below the top tubes from that above, and through this horizontal plate the steam pipes pass with closely fitted openings.

In the center of the netting there is a manhole 18x14 ins., which, when open, enables a workman to get his arms and head well into the upper chamber of the smokebox, and when in, that position he stands directly in front of the exhaust pipe, and within reach of all joints, openings, flanges, etc., which he may wish to get at. A piece of upright netting, about the shape of a half-moon counterbalance, though larger, is placed in the front of the box. This prevents sparks or cinders from getting around the arched netting and from entering the upper chamber without being broken up in passing through the standard mesh.

The deflector plate is not made so as to be adjustable. The central portion is cut in the form of a door, and is hinged from the top, which affords convenient ingress to the flue sheet. Our illustration shows the sides cut to suit the curves of the receiver pipe, but this plate is carried solidly across in other engines, which do not use receiver pipes.

The determination of the position of the deflector plate is arrived at by test for a given class of engine, and when its most satisfactory position has been determined, all the engines of that class are equipped with non-adjustable deflector plates and a certain amount of what is generally called "grief" connected with front ends is thereby eliminated.

The salient feature, however, about the whole arrangement, is its lack of complication and the room and convenience it affords to those who are compelled to work in the smokebox. Lifting up the hinged door in the deflector plate gives immediate access to the flue sheet, and removing the netting manhole cover in the netting gives access to the upper chamber. The rest of the smokebox appears to be positively roomy.

Fast Passenger 4-4-2 Engine for the Pennsylvania Lines West of Pittsburgh.

The engines which we here illustrate were recently turned out of the Schenectady shops of the American Locomotive Company. They are intended to haul seven to ten-car trains on the Pittsburgh & Chicago and the Pittsburgh & Cleveland divisions of the Pennsylvania Lines.

The first ten engines of this order of 32 are equipped with piston valves, as shown in our half-tone. The remaining engines have ordinary Richardson balanced slide valves. The cylinders are 20½x26, and the driving wheels are 80 inches in diameter. The weight carried on the drivers is about 109,000 lbs., and the calculated tractive effort is about 23,800 lbs., while the ratio existing between tractive power and adhesive weight is as 1 is to 4.57.

The valve motion is direct, having a slightly curved transmission bar passing over the leading axle. The valves are outside admission, with $\frac{1}{32}$ in. lead in full gear forward and back. The cross-head is of special form, as are also the guides. The design has been patented by Mr. A. Vogt, the mechanical engineer of the Pennsylvania. The cross-head is in principle a modified Laird cross-head, in which the center line of the piston is considerably below the top of the cross-head. The sliding part is really encased in the guide bar. The guide is designed with broad, flat surface to take the usual heavy upthrust of the cross-head when the engine is in forward motion, but the guide is also made to enclose the sides and a small portion of the underside of the working portion of the cross-head. The cross-head is made of steel and the portion covered by the guide is traversed by two lightening cores, so that the design probably secures the lightest and the strongest form of cross-head yet made for engines of this class.

The boiler is 67 ins. diameter at the first ring, and has a wide fire-box of the Belpaire type. The two injectors are placed on the back boiler head and deliver water to the boiler through one copper pipe which runs forward over the crown sheet, and being joined to an iron pipe just beyond the front end of this sheet the delivery pipe is then bent over to the right side, just clearing the throttle rigging, and delivers water about 30 ins. from the front flue sheet or round head. The crown sheet itself is perfcetly level, and is stayed in the usual way. The boiler is liberally provided with wash-out plugs of ample size, and there are, in addition, two six-inch hand holes in the bottom of the barrel, one near the front and one near the back.

The trailing truck is self-centering; suspension links are used so that the action of gravity brings wheels in position after rounding a curve. The driving tires are secured to their wheel centers by shrinkage and by the Gibson fastening, which consist of a dove-tail ring on the inside and a lip on the outside of the tire, which, when the tire is in place, is driven hard over on the tapering face of the rim of the wheel center.

The work which is being done by these engines is very satisfactory, as shown from the account recently given of a sister engine, No. 7373. This engine ran from Crestline, Ind., to Fort Wayne —a distance of 131 miles on schedule time with the 5-car Pennsylvania Limited, without taking water on the trip. She then doubled back to Crestline, without addition to the fuel supply, drawing eight heavy coaches, and again without taking water on the trip. It was then sent back to Fort Wayne with fuel still on the tender and without taking water en route. The three trips, making a total of 393 miles, was run on 15,000 lbs. of coal, though the allowance which engines of this class are entitled to for these trains is something over 28,000 lbs., therefore, about 13,000 lbs. of coal was saved on the regular coal allowance.

Some of the principal dimensions are as follows:

GENERAL DIMENSIONS.

Weight in working order [illegible] lbs.

Weight on drivers, [illegible] lbs.; weight engine and tender in working order [illegible] lbs.

Wheel base, driving, 7 ft. 5 in.; total, 30 ft. 9½ in.

Wheel base, total, engine and tender, 60 ft. 2$\frac{9}{16}$ in.

Cylinders, 20½x26 in.

VALVES.

Greatest travel of slide valves, 7 in.; outside lap of slide valves, 1⅜ in.; inside clearance of slide valves, $\frac{3}{32}$ in.; lead of valves in full gear, $\frac{1}{32}$ in.

Wheels, dia. of driving wheels outside of tire, 80 in.; tire held by Shrinkage & Gibson fastening.

BOILER.

Working pressure, 205 lbs.

Fire box, length, 111 in.; width, 72 in.; depth, front, 67$\frac{7}{16}$ in., back, 64$\frac{7}{16}$ in.; plates, thickn., sides, $\frac{5}{16}$ in.; bck., $\frac{5}{16}$ in.; crown, ⅜ in.; tube sheet, ½ in.; water space, 4 in. fnt., 4 in. sides, 3½ in. back.

Tubes, material and gauge, iron No. 11, B. W. G.; number, 315; dia., 2 in.; length over tube sheets, 15 ft. 1 in.

Heating surface, tubes, 2 474 sq. ft.; fire box, 165.7 sq. ft.; total 2 639.7 sq. ft.; grate sur., 55.5 sq. ft.

Exhaust pipes, single, low; nozzles, with nipples for blower and fit. with muffler, dia., 5, 5¼, 5½ in.

Smokestk., inside dia., 16 and 18¾ in.; top abv. rail. 14 ft. 11½ in.

TENDER.

Style, with water bottom; wheel base, 20 ft. 6 in.

Tender frame, 10 in. steel channels.

Water capacity, 7,000 U. S. gals.; coal, 10 tons.

ATLANTIC TYPE ENGINE FOR THE PENNSYLVANIA LINES WEST OF PITTSBURGH.

The Canadian Pacific Railway people are still looking abroad for their supply of locomotives. In addition to the engines which they ordered from Glasgow, they have recently placed a contract with a locomotive company at Chemnitz for twenty locomotives. They will be built after the drawings and specifications of the railway company. There is an impression existing that the importation of foreign built engines into Canada will demonstrate how they compare for economy with the American engines, but we do not think that anything of the kind will be shown, because the engines that come from abroad will be precisely the same as those built in the United States by other companies.

Growth of the Locomotive.

BY ANGUS SINCLAIR.

(*Continued from page 248.*)

PIONEER LOCOMOTIVE BUILDING SHOPS.

During the first decade of the railway era in the United States, that is, from 1830 to 1840, the development of the locomotive on native lines was seriously retarded through want of shops where locomotives could be built according to the ideas of American inventors.

As long as the British Government ruled the colonies, the short-sighted policy was pursued of discouraging industries which converted raw material into marketable commodities. The rulers wanted the colonists to devote their energies to the raising of cotton, tobacco and other products of the soil, and to permit the mother country to perform all the manufacturing processes on the raw material. Particular objections were raised against the colonies engaging in iron and steel industries. The rich iron ores found in various localities had tempted the colonists into converting it into marketable iron and steel. This excited so much opposition on the other side of the Atlantic that Parliament repeatedly enacted laws restricting iron making in the colonies, and the exportation of machinery and tools used in metallurgical operations was forbidden. These restrictions helped materially to fan the flames of discontent which culminated in the war of independence.

COLONISTS TAKE READILY TO MECHANICAL PURSUITS.

After independence was won the people turned readily to industrial pursuits, but the art of machine making developed slowly, and it had only about fifty years to grow when the railroad era began. The people in the American colonies were nearly all brought up to the use of the axe, the blacksmith's hammer and other tools, and most of them took readily to mechanical pursuits. In fact, by training and tradition American business men, farmers and others came to consider themselves as good mechanics as those trained to the business, a peculiarity which led men to design and build locomotives without any exact training in the mechanic arts.

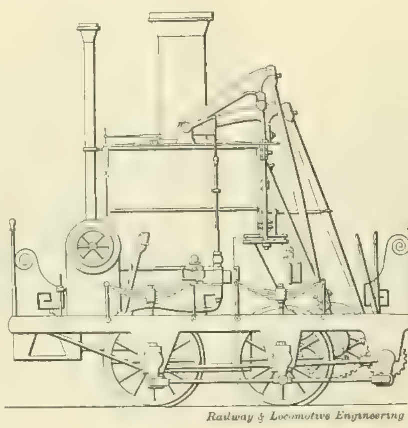
Up to the time that railroad building began, the principal mechanical establishments were forges, wheelwright shops and millwright shops, the three sometimes being combined. In the large cities there were "foundries" which did all sorts of jobbing in metals, and there were also a few jobbing shops devoted to repairing machinery, mostly of tugs and steamboats.

WEST POINT FOUNDRY.

In 1830 the West Point Foundry, New York, owned by Messrs. Kimball, was one of the most important machine shops in the United States, and there naturally went the pioneer locomotive designers to have their engines made. The capacity of the place was, however, limited, locomotive building was not regarded as a promising business, and the concern had all the steamboat and general work it could attend to. On this account orders for the construction of locomotives were refused after four or five had been built.

JAMES' ENGINE BUILDING SHOP.

As early as 1828 William T. James, an inventive genius who had a small machine shop in Eldridge Court, New York, began to experiment in building road locomotives. His first production was a small locomotive with cylinders 2x4 inches, which he ran upon a circular track pulling a train of miniature cars. It was an attractive and popular exhibition, and indicated the interest people were taking in steam applied to land transportation. James afterward built several steam road carriages which were fairly successful considering the kind of roads they had to travel on. He also built two railroad locomotives, one for the Baltimore & Ohio trials which will be described in due course.



ATLANTIC. FIG. 25.

SMALL MACHINE OWNERS AS LOCOMOTIVE BUILDERS.

An agitation in favor of railroad building intensified, various owners of small machine shops displayed willingness to engage in building locomotives which then were no larger than the modern fire engine. The first practical move in this direction was made when Col. Stephen Long, of the United States Topographical Engineers, and Jonathan Knight, the first chief engineer of the Baltimore & Ohio, obtained a charter from the State of Pennsylvania for the American Steam Carriage Company. The intention was to build steam locomotives, but two years elapsed before they built their first engine, and then William Norris supervised the work.

DAVIS & GARTNER AS LOCOMOTIVE BUILDERS.

About the time that Long and Knight were organizing their steam carriage company in Philadelphia, Phineas Davis, a watchmaker, of York, Pa., was interesting himself keenly in locomotives, and studying everything he could find about their construction and operation. When the Baltimore & Ohio directors offered a prize for a locomotive, Davis formed a partnership with a machinist named Gartner, and they proceeded to build a locomotive which was completed in a few months and was called the "York," particulars of which have already been published. The success of the "York" brought to Davis & Gartner orders for two more engines. The second engine of their build was called the "Atlantic," Fig. 25, an engine weighing about 14,500 pounds, then considered a little beyond the safe weight for locomotives running on strap rails. The finger marks of Ross Winans were very prominent on this engine, which had several important improvements over the "York," and was regarded for the time as the standard of weight and power for a grasshopper engine. The third engine built in the "York" shops was called the "Traveler." It had the power at first transmitted direct to a cranked axle, but that breaking, the engine was changed to conform to the design of the Atlantic, which transmitted the power through gearing and a supplementary driving shaft. The "Traveler" completed the locomotive building of Davis & Gartner, as the Baltimore & Ohio Railroad Company built shops for themselves which were ready in 1833, when it was expected that all locomotives required could be built and repaired.

WATCHMAKERS AS LOCOMOTIVE BUILDERS.

In connection with the engineering work of Phineas Davis, it is interesting to note that he was a watchmaker by trade, and that two others who built locomotives for the Baltimore & Ohio competition were trained to the same business. Matthias W. Baldwin, who established the most successful building locomotive works in the world, was trained to the trade of a jeweler. This is a good illustration of how native genius will assert itself and defy adverse circumstances of early training.

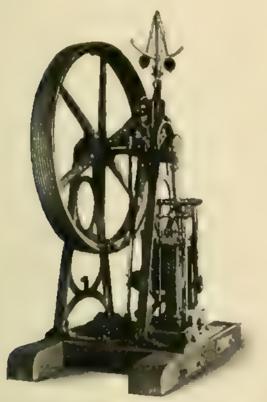
COSTELL ORGANIZES LOCOMOTIVE BUILDING SHOPS.

Another aspirant at establishing a locomotive building shop was Stacey Costell, a watchmaker, who in 1831 organized the Pennsylvania Locomotive Works, of Philadelphia. Under the direction of Costell a locomotive with double acting oscillating cylinders was built in the works for the Baltimore & Ohio competition which did not prove a success, and its failure led to the closing up of the locomotive building shop for good.

There were a few other tentative shops started where a few locomotives were built, but most of them failed. Those which succeeded in keeping at work for five years have become historical.

ORIGIN OF THE BALDWIN LOCOMOTIVE WORKS.

The pioneer successful locomotive building shop was started by Matthias W. Baldwin in 1831. Mr. Baldwin learned the jeweler trade in Philadelphia, and in 1819 opened a small shop on his own account. Six years later he entered into partnership with David Mason, a machinist, to engage in the manufacture of book binders' tools and cylinders for calico printing. The business was so successful that steam power became necessary, and Mr. Baldwin designed and built an engine which proved particularly well adapted for the requirements of the shop. The success of this engine led the firm into the business of engine building, and turned Mr. Baldwin's attention to steam engineering, and the way was prepared for his grappling the difficult problems of locomotive construction.



BALDWIN'S FIRST ENGINE. FIG. 26.

BALDWIN BUILDS A STATIONARY ENGINE.

The first stationary engine (Fig. 26) built by Mr. Baldwin prior to 1830 is still in good order, preserved in the Baldwin Locomotive Works. It has successively supplied the power in six different departments as they have been opened, from time to time, in the growth of the business.

INTEREST IN MECHANIC ARTS IN PHILADELPHIA.

Philadelphia has always taken the lead in the development of the mechanic arts in the United States. It was therefore natural that public curiosity should be excited by everything relating to the railroads that were creating much discussion at home and abroad. Everything relating to this novel form of land transportation must have been the town talk of intelligent people in Philadelphia in 1830 and 1831, for railroad building schemes for the neighborhood were very numerous, as may be judged from the fact that Pennsylvania State reports intimated that there were sixty-seven railroads in operation in the State in 1832.

Most of them were small, of course, and some of them were crude tramways with wooden rails, but their existence indicated vigorous activity among railroad promoters. The coal that was being mined in increasing quantities had to be conveyed as cheaply as possible to points where water carriage would convey it to a market, and a wooden tramway enabled a horse to haul a much heavier load than could be moved over the execrable roads then the rule.

BALDWIN BUILDS A SMALL LOCOMOTIVE.

In 1830 Franklin Peale, then proprietor of the Philadelphia Museum, resolved to gratify public curiosity concerning railroads by introducing into his establishment a small working locomotive and train of cars. He naturally applied to Mr. Baldwin to make the engine, for that gentleman had become the best authority on engine building in the Quaker City. The work was duly carried out and the engine was put into operation on April 15, 1831, pulling two small passenger cars which seated four passengers, around a circular track in the museum.

BALDWIN RECEIVES ORDER FOR ROAD LOCOMOTIVE.

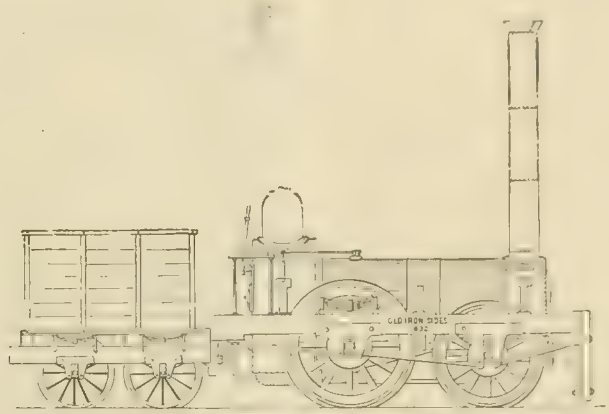
Shortly after the Peale model engine was put to work the Philadelphia, Germantown & Norristown Railroad Company ordered from Mr. Baldwin a locomotive to operate their line, six miles of which had just been finished, and was operated by horses. The Camden & Amboy Railroad had imported their famous "John Bull" from the works of Robert Stephenson & Co., a short time before, and this engine was stored in a shed at Bordentown. Mr. Baldwin, in company with his friend, Mr. Peale, visited Bordentown and carefully examined the parts of the engine, which were not yet put together. He took some sketches and memoranda and with the aid of these undertook to build a full-size locomotive.

THE "JOHN BULL."

The English engine which Baldwin used as a pattern has generally been called of the "Planet" class of engine. That is not exactly correct, for the so-called Planet class of engine had one pair of big driving wheels placed in front of the firebox, and one pair of small carrying wheels placed under the smoke-box. The "John Bull" had two pairs of wheels the same size coupled. The first engine of that type was built for the Liverpool & Manchester Railway in 1831, and was called the "Samson." Nearly all the locomotives which Robert Stephenson & Co. sent to the United States were of this Samson pattern.

"OLD IRONSIDES" BUILT.

Mr. Baldwin proceeded with the building of the engine for the Philadelphia, Germantown & Norristown Railroad, and it was first tried November 23, 1832. It was called the "Old Ironsides" (Fig. 27). It was a four-wheel engine with the driving wheels in front of the fire-box and the carrying wheels close behind the smoke-box. In working order the engine weighed about 11,000 pounds. The cylinders were 9½x18 inches, the driving wheels were 54 inches, and the front wheels 45 inches diameter. The boiler was 30 inches diameter and contained 72 copper flues 1½ inches by 7 feet.



"OLD IRONSIDES." FIG. 27.

The builder experienced considerable trouble before he got the "Old Ironsides" to work satisfactorily, but the difficulties encountered were as nothing compared with those the English builders had to overcome.

The engine was put into regular train service with as little delay as possible, and the railroad company displayed solicitude about the care of the engine which was in striking contrast to later day practice. They advertised that their new locomotive engine would haul cars at certain times if the weather was fair, but when it rained the cars would be pulled by horses.

GREAT SPEED ATTAINED BY THE "OLD IRONSIDES."

According to an article which appeared in the *Railroad Journal* for 1833, Dr. Paterson, of the University of Virginia, and Mr. Peale, rode on the engine and kept the time when, with its regular train, it

ran one mile in 58 seconds, and 2¼ miles in 3 minutes and 22 seconds.

ORGANIZING A SHOP.

The most important work which Mr. Baldwin performed in connection with the building of his first locomotive was the organizing of shops where such work could be carried on. He was very much in the position that James Watt was when building one of his first engines. After the cylinder was bored he reported that the work was so well done that he could not push a half crown between the piston and the cylinder at any place. Mr. Baldwin suffered from the want of skilled mechanics and had to instruct workmen besides designing and building many of the tools employed.

THE NORRIS WORKS STARTED.

Col. Long, whose name has already been mentioned, was assailed with a virulent fever of locomotive designing and building, from which he suffered for several years. Having met William Norris, a business man of Baltimore, he infected that gentleman with the same fever.

These two enthusiasts formed a partnership, and under the name of Long & Norris became successors of the American Steam Carriage Company. They began to build locomotives in Philadelphia about the same time as Mr. Baldwin, and had a very checkered career for several years, but Mr. Norris persevered and made the business successful. The Norris Works built one locomotive in 1832, one in 1833, one in 1834, two in 1835, eight in 1836, and so on in increasing scale up to one hundred in 1854. Upward of 1,000 locomotives were built in the Norris works, and of these 17 were exported to the Birmingham & Gloucester Railway, of England, and 153 to the continent of Europe.

There was a keen rivalry between Baldwin and Norris in the early days, and the engines of each had their friends and detractors. The engines of the two builders were developed on similar lines so far as power and weight were concerned. Baldwin placed the drivers of his engines behind the fire-box and Norris put them in front of the fire-box. The merits of the relative positions excited no end of discussion among the railroad men of that day.

William Norris afterward established locomotive building works in Vienna, and Colburn, author of a well-known history of the locomotive, says that his models of locomotives were reproduced with trifling alterations by M. Meyer, who still enjoys the credit of originating a variety of valve gear which was introduced from the United States.

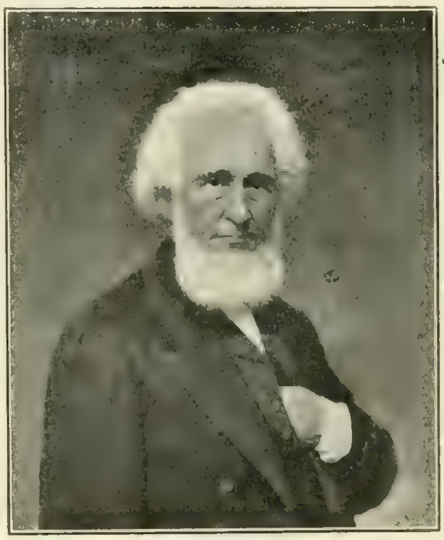
(*To be continued.*)

Ross Winans.

BY E. J. RAUCH.

The name of Ross Winans is certainly deserving of a place among the names of the locomotive builders of America. He was in the business early in the advent of railroads in this country; and invented and built many locomotives that were equal to the best, and superior to many, of those built by others of the same day.

He early turned his attention to the construction of locomotive engines to use bituminous coal as a fuel, and for years held the "palm" for such engines. Somewhere about 1844 or '45, the Philadelphia & Reading Railroad began experimenting with anthracite coal as a fuel for their engines. It was not a success and Winans was called on to build an engine for that company. He would not contract for one engine, but agreed to build four—which he did. The first one of the four was named "Baltimore," an 8-wheel connected engine—horizontal cylinders—18x20 inches, 4 6-inch solid cast-iron wheels, weight about 22½ gross tons. She was fitted with a variable exhaust controlled by the engineer; and considering the limited knowledge of the engineers and firemen of those days, was a grand success.



ROSS WINANS.

Right here trouble came in for Mr. Winans. The Philadelphia & Reading people had commenced the construction of a coal-burning engine, and not being able to get it built before the advent of the Winans engine, numerous objections were raised against her, in order to keep her back until the Philadelphia & Reading engine was in service. First she was found to be too wide across the cylinders by an inch. Winans came to Reading and brought with him a couple of machinists who took off an inch and a half of the flanges of cylinders, and so reduced the width.

Next objection was that the weight on back axles was much too great. Again Mr. Winans came to Reading bringing his draughtsman, Mr. Whistler, and took some measurements. In about two weeks Winans again appeared with some mechanics, and a lot of appliances that he placed against the fire-box behind the axle and under the foot-board that took, at first, too much weight off the hind wheels. A small strong pad was put on fire-box near the grate line and just behind the wheels on both sides. A steam cylinder was attached to each side of the fire-box, below the foot-board; a pair of 14-inch wheels was placed on track close behind the fire-box; a spring, half elliptic, ran from the pads at one end, to the axle box on the wheels at other end. On top of this spring nearest the back end was a boss with a countersunk socket. From the piston, in the steam cylinder, the rod ran down and rested in this socket. When steam was on the boiler the same pressure was in these cylinders, and, of course, lightened up the rear end of engine. The device worked nicely until by any chance those carrier wheels dropped off the track. Then the spring fell away from the piston rod, there was no head to lower end of the cylinder, and no check between the cylinder and boiler; and, of course, the water was all blown out.

When James Millholland became master mechanic of the Philadelphia & Reading in 1847, and demonstrated to that company that their effort to use anthracite coal with the "Novelty" was a failure, these carrier wheels were discarded on the "Baltimore" and the three other engines that meanwhile had been delivered. Owing to the construction of the rear end of the fire-box of these engines, the pulling bar was attached by one end to the ash pan, and other end to a bolster of front truck of tender, passing under a pit in front of tender from which the fireman fed fuel to the fire-box.

The back end of the fire-box was open from grate to crown sheet. This space was filled in with the fire doors. The lower door was an open grate reaching across the fire-box. Above this door were two solid doors for firing through. The grate bars extended out beyond the lower fire door, and by means of a lever could be raked, thus breaking any clinker that might have formed, and shaking it, with the ashes, into the ash pan. The arrangement was a good one; giving clear access to the fire, also allowing it to be drawn quickly in an emergency, by opening the fire doors.

Winans adhered to this plan of grates and fire doors in nearly, if not quite, all the engines he subsequently built.

About 1850 or '51, Mr. Winans began to send some "camel back" locomotives to the Philadelphia & Reading

Railroad. He seemed to have recognized the necessity for the engineer having a better chance to see where he was going, as the cab on these engines was on top of the boiler and engineers stood close behind the smokestack. About 1854 or '55 Winans built and sent to the Philadelphia & Reading a unique passenger locomotive. Boiler was of the long fire-box, 7 foot grates—"camel back" type. To show the excellence of his boiler makers' skill, there was no jacket or covering of any kind on the boiler. It was hammer hand riveted, but not a hammer mark was visible on the sheets. The engine weighed about 22½ tons, was 4-wheel connected, with a 6-foot spread truck. Driving wheels five feet diameter—cast with tire entire. Cylinders 19x22 inches. The peculiar feature of this engine was the cab location, which was on the platform of front end.

Being fitted with the Winans' hook and cam motion valve gear, the reverse lever, starting bars, hand levers, and gauge cocks were all in the cab within easy reach of the engineer.

This engine, "The Celeste," was run on passenger trains for several months, but owing to the cast-iron driving wheels being thought unsafe was changed to other service. At first there was some trouble with the spread truck boxes running hot, but the master mechanic of the Philadelphia & Reading found a remedy. After about three years' service, one of the driving wheels did break but did no damage.

The Philadelphia & Reading Company not being able to build locomotives fast enough to keep up with the demands of the fast increasing coal trade, Winans placed a large number of his engines on that railroad. They were different from the original "camel back" in the length of the fire-box, which sloped, with flat surface, from line of top of boiler to about a center line through the same. On this slope there were two chutes opening into fire-box, one near flue sheet and the other about center of fire box. These chutes had doors top and bottom, and were filled with coal and the coal was dumped into fire-box without the admission of cold air. With poor fuel, these chutes very materially helped the steaming of the boiler. These engines all had a "cam motion" cut-off, which was operated by the same lever that controlled the hooks of eccentrics. It was simply thrown one notch ahead of forward hook motion to put cam in gear. All the hooks were controlled by segments of discs on a shaft running across from frame to frame under them. If the engine ran over any obstruction that knocked out this shaft, all the hooks dropped in gear in the rocker shaft, and disconnecting of valve motion was complete.

Ross Winans had no belief in a combustion chamber in a locomotive boiler. His theory, as carried out by him, was, as much grate and flue surface as you can get, and as few parts as will do the work. The side rods of his engines were fitted with bushings for the pins, and his main rods had only gib and key to hold on the straps at front and back ends. The writer was among Winans' engines and ran many of them during a term of 15 or 16 years, and never knew of a main rod disconnecting.

On one of the earlier Camelbacks sent by Winans to the Philadelphia & Reading Railroad was a steam gauge, probably the first one on any locomotive. It was a double diaphragm, about 24 inches in diameter, attached to lower part of the boiler, near the front end. A pipe ran from this diaphragm up to about the center line of the boiler, to keep out the mud. From a stud on this diaphragm across the center a compound lever ran to near the right-hand frame, and was there attached to a rod running up to a guide in cab close to engineer. The change is pressure caused this rod to rise or fall through the guide and thus indicate the boiler pressure. It worked well.

Another feature of the Winans' locomotive was his "variable exhaust." It was certainly among the best, if not the very best, appliance of the kind ever in use.

The Winahs Shops at Mt. Clare, Maryland, were a model of economy and system. The erecting shop was one long, straight track from boiler shop to a connecting siding of the Baltimore & Ohio Railroad. The finished boiler was rolled on small trucks from boiler shop to the near end of the erecting shop. All the various parts of the machinery for engines were placed in the erecting shop, on both sides, and were taken up and attached in place to the virgin boiler in the order they were needed, the boiler being moved along as required until the finished engine was pushed out the doors to the street. In a busy season half a dozen boilers, in all stages of progress, would be on this line at same time.

The breaking out of the war in 1861 in some way interfered with Mr. Winans' business, and he dropped out of notice.

New York, May 25, 1903.

GREAT NORTHERN OF ENGLAND—ATLANTIC TYPE ENGINE, VESTIBULE CORRIDOR CAR TRAIN, LONDON-LEEDS SERVICE. PULLMAN VESTIBULES WITH GOULD AUTOMATIC COUPLERS THROUGHOUT.

Voluntary Advance of Foremen's Pay.

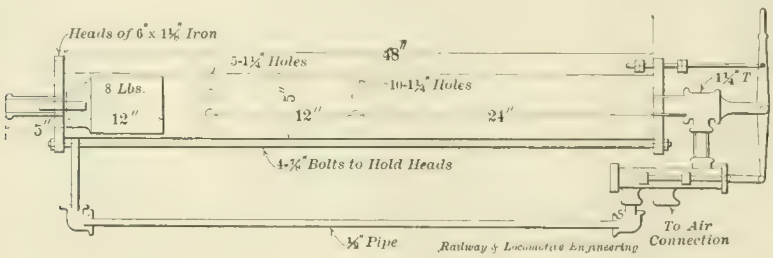
Information has been received that the mechanical department of the Erie Railroad has increased the wages of foremen in sums ranging from $5.00 to $25.00 a month. This is a move in the right direction and we should like to see other railroad companies giving more salary to the men who perform the important duties in carrying on the work in different departments. Naturally a foreman cannot agitate for increase of pay, or, at least, cannot put any pressure upon the powers that pay to convince them, that foremen ought to be better paid than most of them are, and, therefore, they are habitually left without any advance while all the workmen in the establishment receive increase of pay. We often hear the expression made that men would be paid just wages without any agitation to secure the same, but the underpaid foreman is a standing reproach that justice will not be done unless under threats more or less impressive. The underpaid foreman is a standing object lesson to members of labor unions, for it teaches them that it is only by the force resulting from combination that will bring them a fair remuneration.

General Correspondence.

Pneumatic Hammer for Shop Work.

Inclosed is a sketch of a pneumatic hammer that we are using here. It is one I designed myself and is not patented. You will note the sketch shows a 58-pound hammer. I made one with a 22-pound hammer for driving out flues. The one shown is the one we use for breaking out staybolts and shearing crownbar bolts. It will shear a 1-in. bolt at one or two blows, and can work at the rate of 50 or 60 blows per minute. The smaller one will knock out a set of 200 flues in one hour and thirty minutes. It takes two men to operate either hammer.

The valve for the large hammer is of the piston variety; it has two rings on each head. The heads are 1⅜-in. diameter, ¾-in. thick and coupled on a ⅝-in. rod 4⅛ in. apart, back end of the stem being coupled to a lever. The bushing is 1⅜ in. on inside, 1⅝ in. on outside, and is 10½ in. long.



AIR HAMMER.

The casing for the bushing is made of three 1¼-in. gas pipe Ts, with the thread drilled out to 1⅜ in. in diameter, and the center bored out ⅛-in. large to allow the air to pass entirely around the bushing. They are held together with a collar on one end and a nut on the other end of the bushing. The bushing has twenty-six ¼-in. holes for each port, the holes are arranged in two rows running entirely around it, thirteen in each row. The ends of the T are faced off to insure an air-tight joint. The barrel of the hammer is common 5-in. pipe, with heads grooved for pipe to fit in, and held together with four ⅞-in. bolts. The barrel is 24 in. long, with ports drilled as shown in sketch to allow pressure to escape and prevent a rebound. The hammer is made from an old crank-pin turned to fit the pipe loosely, the pipe not being bored. The smaller hammer has only one row of holes at the end. It is about 7 in. long. Each hammer has a steel pin in the end to strike the bar, which is held by the gaspipe as shown in sketch. The small hammer uses 1-in. Ts bored in the same manner as the large one. Both hammers use the same bar, which must be a fair fit in the 1¼-in. pipe. The small hammer is very convenient where a heavy blow is wanted on a bar, and can be operated easily and quickly.

R. M. Cole,
Foreman U. P. Shop, Ellis, Kas.

Good Receipt for Hot Box Dope, Lost.

Some years ago there was an engineer who did not think he knew it all by any means, and was, on the whole, a "good sort," but he omitted to tell his fireman the contents of his orders one beautifully fine afternoon, and several people were thereby enabled to see his finish. He had taken an engine out of the back shop after a general overhaul to give it a trial trip, and he had a machinist along with him, as well as the fireman.

This happened on the High & Fly Railroad, which road believed that the train dispatcher was .987 of the whole thing, and they never found anything like as much fault with him as they did with the engineers, and as he did most of that kind of work for the company, it saved a lot of worry at the top.

The arrangement about the light engine was that if it ran all right it was to go on to the end of this division, for service on the next division, and the machinist was to go back to headquarters at the first crossing that was made, if the engineer was satisfied. This crossing was with a regular passenger train. In starting off there was so much talk about this and that, that the engineer forgot to show the fireman his orders, and the fireman for some reason or other did not ask to see them.

When they were out on the road, the only thing which gave any trouble was a hot big end, but the engineer thought he could manage that all right, so the machinist returned home leaving the engineer and fireman with his very best wishes and plenty of oil and soap and sulphur and all the hot-box killers on the calendar.

Now, the train order which the engineer carried and of which the fireman was ignorant, was properly addressed and dated, and read something like this: "So and so will run from A to Z, keeping clear of regular and signal trains, and will hold for orders at Q." After the regular passenger train which took the machinist back had been passed at K and other trains looked out for, there was a clear, good run to Q, so the engineer "speeded her up," and as a result arrived at M with the left big end pretty hot. It gave trouble for awhile, but showed signs of cooling at Q.

At this station the "hold for orders" came into operation, but the engineer was so intent in looking after the hot big end and his mind was occupied thinking about a triumphant compounding of a superb "dope" made out of everything on the engine, that he forgot all about holding for orders, and the fireman knew nothing about it, and the operator at Q knew nothing about it, as he hadn't been told. This operator had not seen this particular engineer for some time, so he came out and shook hands and asked how things were going. They talked about everything but the hold for orders—principally about the triumphant dope, and the engineer and fireman climbed into the cab and went on, after asking the operator to book them in and out, and the most superior dope on the whole road was fairly dripping off the left big end.

Two or three miles out they came upon a long tangent and found that they were running against a fast freight. The fast freight saw them and rent the heavens asunder with a long, shrill scream. The light engine stopped in lots of time and the freight did also, so there was no collision *de facto*, though there certainly was a bad smash *de jure*. The light engine backed up to Q, and the freight came on with caution.

There was no attempt to hush it up. In fact, the operator at Q had reported the deparure of the light engine when it went on, so all hands made telegraphic explanations, each winding up with most touching allusions to there being no damage of any kind to anything and only an exceedingly minute loss of time to the freight—you couldn't see it with a microscope!

New orders were issued to the light engine and the fireman read them over five times aloud and they went on, and the superior dope simply acted like a charm and the engine came into Z with everything stone cold, including the feet of the crew.

Now, after the "carpet" had been trodden upon by everybody concerned, there was a vacancy for an engineer on that di-

vision and the receipt for the triumphant superior dope was utterly lost to the H. & F. road, and it was A1 dope, too.

Moral—When it comes to a case of depending upon human memory, two or even three heads are better than one, and why shouldn't the fireman have a written copy? The man issuing orders should tell all concerned and be careful about it.. Rattling good dope should never be manufactured on a light engine, even by an expert, and few dispatchers should be considered more than .922 of the whole thing; .987 is rather high. A. O. BROOKSIDE.

A Trip Over the Scenic Short Line.

It was my good fortune on May 2 to make the trip from Colorado Springs to Cripple Creek on the Colorado Springs & Cripple Creek District Railway, as the guest of Mr. William Lennox, vice-president of the line.

I doubt very much if any other road can lay claim to as perfect a roadbed as the Scenic Short Line has. Built high up along the mountain sides, the line, standard gauge, laid with 75-pound steel rails and ballasted with disintegrated granite, is entirely free from dust in summer or snow in winter. Although the line is all curves and turns, the roadbed is so perfect that its many reverse curves are imperceptible to the traveler, and consequently no one ever suffers from the sea-sickness so often experienced on mountain roads.

The engineering achievement is so marvelous and stupendous as to beggar comparison with anything of its kind. No expense has been spared by the management to provide for the comfort and safety of its patrons. The coaches are of the latest design and are truly traveling palaces. Each train is provided with observation cars free to all passengers. The locomotives are powerful mountain climbers and the best that money can purchase.

Our day for sight-seeing was clear and warm—ideal Colorado weather—and added greatly to the enjoyment of the enchanting and bewildering scenery en route.

As we left Colorado Springs on the regular morning express, Nature began to unfold her beauties to us at once and in rapid succession. Scarcely two miles out and to the right below us lay Colorado City, the first capital of Colorado. Then came the Garden of the Gods, and a little farther up the canon, Manitou nestling at the foot of Pike's Peak.

We are now in Bear Creek Canon, away up among the lofty mountains, and nearing North Cheyenne Canon. Skirting around Cheyenne's rim and we are at Point Sublime, seven miles from our starting place. Looking down through beautiful North Cheyenne Canon we get a magnificent view of Colorado Springs, 1,200 feet below us. Still moving onward and upward, a short distance to our right we see the Sparkling Cascade Falls, hundreds of feet above us. Soon we are at Fairview, the confluence of North and South Cheyenne Canons. Who has not heard of beautiful South Cheyenne Canon, forever associated in memory with Helen Hunt Jackson, the gifted writer, whose body was laid at rest there in a lovely spot near Seven Falls.

We are moving on to new wonders. Several thousand feet above us is somber old St. Peter's Dome, a mountain of granite, one of God's master works, looming up majestically and defying the elements for ages.

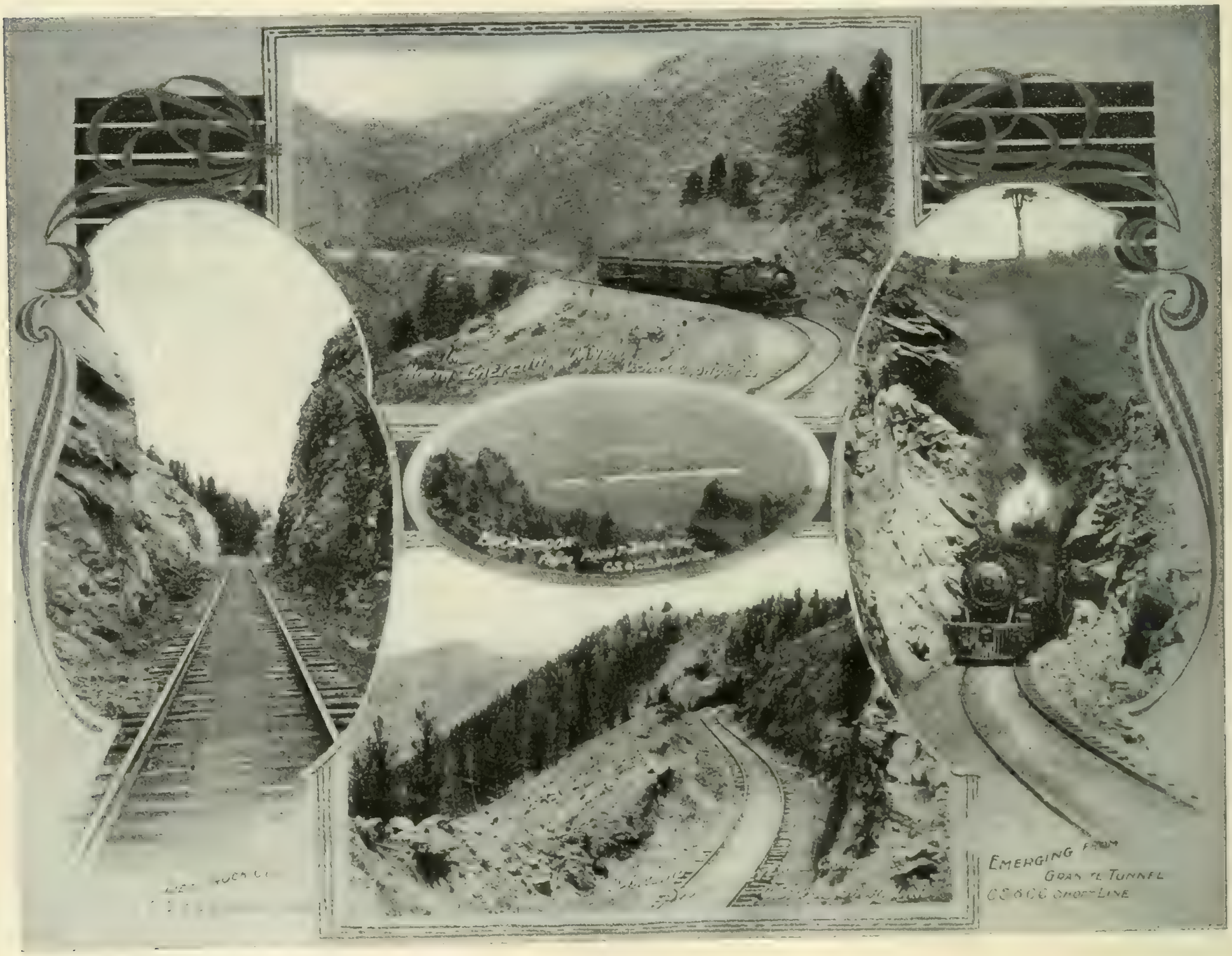
Our iron steed, throbbing with every exhaust as though a thing of life, fol-

lows the serpentine trail up St. Peter's and brings us to the opposite side of South Cheyenne. The matchless view here baffles all description. There is nothing to be compared with it elsewhere.

Following the trail we reach Duffield's, where we get our last view of Colorado Springs and the vast expanse of rolling plains off in Kansas, a hundred miles away. Three miles from here and twenty miles from our starting point, we cross the summit at an altitude of 10,360 feet, or almost two miles above the sea level.

As we begin to descend we get a fine view of Pueblo, forty-five miles away, with her factories and smelters belching forth clouds of smoke. Onward we roll, now over mountain torrents, now through aspen forests, and in full view of four tracks below us which we shall pass over. Soon we are at Clyde and gazing at the panorama of Cathedral Park, with its rocks in fantastic shapes, eroded by the elements thousands of years ago.

Nearing the end of our journey we see to the left the famous gold camp, Bull Hill. At Cameron we take the line that diverges to Cripple Creek. Here we have a magnificent view of Pike's Peak and the Sangre de Cristo (Blood of Christ) range of mountains.



After a short stay at Cripple Creek we took the electric line to Victor and inspected a gold mine. The whole country for miles is dotted with dividend-paying mines, which with their groups of buildings look like monster bee-hives.

From Victor we took the steam line again and began our homeward trip.

The continually changing scenes from different vantage points on our return were as fascinating as those we enjoyed on the upward trip. I know that the members of the Air-Brake Association, who, through the kind hospitality of Mr. F. S. Smith, general superintendent, and the management of the line, had the good fortune to make this same trip, will agree with all I have written here, but I feel my description is entirely inadequate.

To our eastern friends contemplating an outing this summer I would suggest that a trip over the Santa Fe or Rock Island to Colorado Springs and thence over the Scenic Short Line will repay them a thousandfold in present pleasure and future remembrance.

Jos. A. Baker.

Useful Numbers.

A great many readers of Railway and Locomotive Engineering failed to apply the arithmetic they have learned at school, and we are continually receiving requests to answer questions that every school arithmetic solves. Before us is a question of how many revolutions driving wheels of a certain diameter make in a mile. To this we answer: Multiply the diameter of the wheel by 3.1415926, which is the ratio of diameter to circumference of a circle. Divide 5,280, the number of feet in a mile, by the product, and the quotient will be the number of revolutions in one mile.

The following are a few numbers that are frequently used in engineering articles:

.7854 = ratio of area of circle to square of its diameter. 33,000 minute-foot-pounds = 1 horse power. 396,000 cubic inches displacement per minute of engine wheel would develop 1 horse power, with 1 pound mean effective pressure on the piston. 55 pounds M. E. P. at 600 feet piston speed gives 1 horse power for each square inch of piston area.

Points Regarding a Monitor Injector.

For the information of those who use injectors, especially the Monitor injector, I may say there have been many failures or so-called failures, where, if the man in charge of the engine was posted on the injector, there need not have been even a detention. If we count the globe valve on the turrett as one, the Monitor injector has eight valves. If the man in charge understands the injector he can take out five of the eight valves and work the injector to a great degree of success, or so well that it will not be necessary to dump the fire or make any great delay to train.

First, if the check valve in boiler is all right we can take out the line valve. Then we can work the injector without the overflow valve. Gifford never had a valve at the overflow, so you see we can do temporarily without it. Then we take out the priming valve, put the plug and stem back to its place. We operate the priming by shutting off globe valve on the turrett. Every time we work the injector, all the loss we are at is the small jet of steam that will flow through the priming nozzle, which will be of small account, the injector will work O. K. Then we can take the feed water valve out, and by cutting down the feed by putting a piece of paper or a small handful of ground stones in the strainer. the injector will work at high or low pressure, and of course everybody knows an injector will work with the tank valve out. So you see we can get along without the line valve, priming valve. feed or graduating valve, tank and overflow valve, making in all five valves we can dispense with. A. J. O'Hara.

Air-Operated Fire-Door Opener.

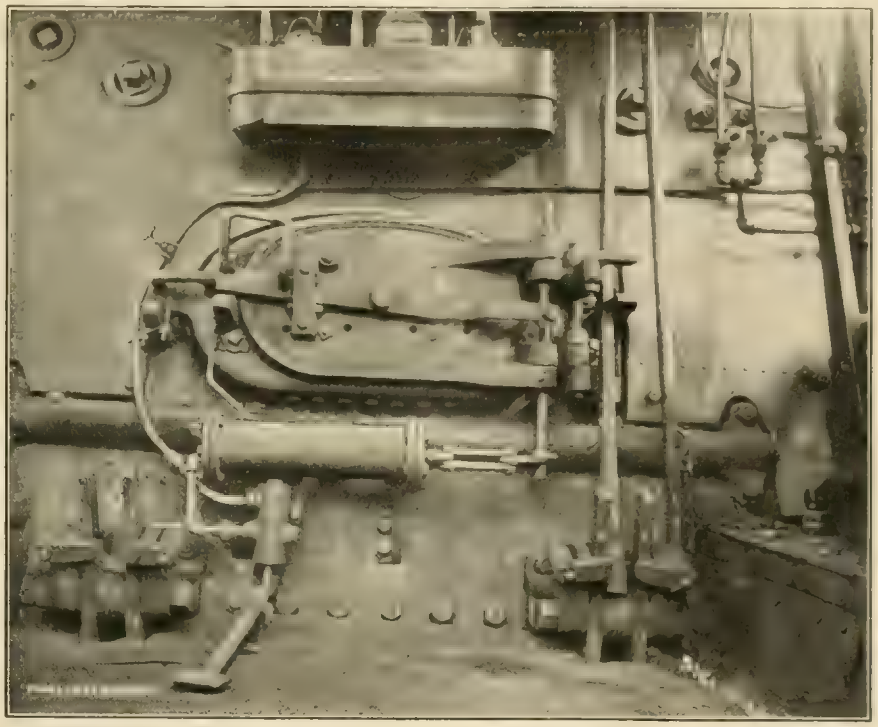
The accompanying illustration is of an automatic device used to open and close the fire-door. It is the invention of Mr. F. L. Brewer, engineer on one of the Rock Island's limited trains and a pioneer in their service.

A glance at the picture will show the advantage the contrivance possesses as an assistant to the fireman and a reducer of the number of leaky flues. Mr. Brewer has had it in use on engine 1004,—the engine in his charge, for the past twenty months, and up to the present time no repairs to it have been necessary.

It is very simple in construction. Whenever the fireman wishes to replenish his fire, he places his foot on the pedal and thereby opens communication from the small to the large cylinder by means of a piston attached to the pedal. As he turns toward the tank after another shovelful of coal, he removes his foot from the pedal and the door closes and latches itself automatically. The boilerhead shown in the picture slopes at the top toward the forward end of the cab, and the door is of a kind hard to operate and consequently often kept open until the fireman has given the engine an over-abundance of coal, also cold air and leaky flues.

The C. & E. I. are using the device with excellent results and have reduced their boiler repair work 50 per cent. since it has been applied. The C., M. & St. P. are also giving it a trial, and have applied it this week to one of their engines running out of Chicago.

J. A. B.



AIR-OPERATED FIRE DOOR OPENER.

Notes of a Trip on the Illinois Central.

When Horace Greeley advised young men to "Go west," he probably meant "Go southwest." However, the opportunities of his time can be duplicated today. Immense tracts of timber and other lands are still open to purchase by the man of small means as low as $10 per acre along the lines of the Illinois Central. When cleared of timber at a good profit, the soil will produce in abundance any of our northern or southern fruits or grains.

Having occasion to go as far south as Memphis, I chose my route over the Illinois Central, stopping off at Kankakee, Champaign, Mattoon, Centralia, Carbondale and Cairo on the way down, and returning by way of Paducah and Evansville.

Kankakee, fifty-five miles from Chicago, is a pretty place situated on both sides of the Kankakee River. Among its chief industries are the immense stone quarries of the Sinclair Construction Company, which supply the Illinois Central with crushed rock for its roadbed, and give employment to hundreds of men.

My next stop, Champaign, gave me an opportunity to see the University of Illinois, with its score of buildings nestled among a grove of native trees. Here I also remarked the enormous amount of traffic passing in almost rhythmic precision up and down the line, products from Chicago to the South and Gulf ports, and New Orleans products for Chicago and the East and West.

At all of the stopping places mentioned above I found repair shops with the latest improved machinery, giving employment to many men. The power of the I. C. is in excellent condition, due to the manner in which it is handled by the mechanical department. Prompt service in both freight and passenger departments seems to be the first consideration. To accomplish this their engines are not over-loaded. All freight seems to be fast freight with them, be it fruit, garden truck or coal. The enginemen have "caught on" to the idea and their proper aim is to "get there"—and they generally do. Taxed to the utmost for power, leasing engines wherever they are to be had, the transportation department has succeeded, through its wise management and the hearty co-operation of the mechanical department and its engine men, in averting a congestion of freight at the division terminals.

Not satisfied with the large returns which nature gives them from the soil, the farmers in this section are claiming a portion of her secret hoard, and all

the way from Kankakee to Cairo it was quite a common sight to see a fruit orchard and grain field on one part of a farm and a coal mine on another.

Entering Cairo the railroad takes a straight line on the east side of the town, following the banks of the Ohio. Leaving, it takes a circuitous route along the west side of the town, forming a huge letter S in order to reach the two-mile bridge spanning the Ohio, three miles north of town and connecting the States of Illinois and Kentucky. While on this bridge one gets a fine view of the Ohio River emptying into the Mississippi. The two currents can be distinguished by their different shades of muddiness. The Mississippi is probably three miles wide here, and opposite the Ohio's mouth large islands dot the surface of the stream. We see three States—Illinois, Kentucky and Missouri—whose territories are divided by these mighty streams.

Going south toward Memphis, we pass near six different health resorts in Kentucky's famous hills, which can be reached only by the Illinois Central, and which offer every convenience and comfort to the invalid.

Although the entire system is double tracked, still the company, looking to the safety of its patrons, is installing the Hall Block Safety Signals. An immense amount of money is also being spent in cutting down grades between Cairo and Memphis, and replacing wooden bridges with concrete and iron structures. The company has inaugurated a system of very cheap excursion rates at frequent intervals, good on their fast trains to intending investors. The dining-car service à la carte is fine, and the lunch counters rank with the best anywhere.

I was tired of sight-seeing when I reached Memphis, the half-way station between Chicago and New Orleans, but even a weary traveler is roused to interest in this old town with its wide streets, modern buildings and factories. Since the war it has become the distributing point for Arkansas and the far Southwest. Every stranger goes down to the river to see the Mississippi and the forests of Arkansas on the opposite shore. While I was there one of Uncle Sam's watch dogs of the navy, the *Arkansas*, was anchored in mid-stream. One unusual pleasure for a Northerner is to listen to the darkeys singing negro melodies while transferring freight from the wharves to the river-packets.

Thoroughly satisfied with the trip, our party, consisting of myself, suit case and umbrella, started on our homeward journey. If you have a little money to invest, if you want a pleasure trip, or if you want to get away from the cold northern winter, take a trip over the Illinois Central to Memphis or New Orleans, and you will be "on time" all the way and well pleased with your journey. Speed and promptness, being essential in Uncle Sam's service, secured for this line the government contract for carrying the southern fast mail. J. A. B.

Running Railroad with Relatives.

Several years ago a small road, the P. D. S., concluded that a traveling engineer was a necessity, and engaged the services of a bright and experienced man from one of our great trunk lines.

The first thing which the new traveling engineer encountered, and which acted as a damper on his enthusiasm, was the family ties that existed in all the departments except those of the general superintendent and superintendent of motive power. These relatives seemed to think that the road was built for their especial benefit. All of them had their hobbies and several their pets. Particularly was this the case with the superintendent and train-master, who, to make matters worse, compromised themselves by borrowing money from their subordinates in sums ranging from $50 to $900. It goes without saying that these officials were incompetent and that the rule regarding employees standing in line of promotion, if competent, was a dead-letter.

The general superintendent was up to date and very kind hearted, but, like the traveling engineer, handicapped by the general manager, who vetoed every innovation as an extravagant and useless expenditure. However, when the G. M.'s son, who was in the Maintenance of Way Department, wanted a gasoline motor car at the company's expense, that seemed a necessity, and the young man got it. It was very handy for taking his friends along the line for an outing, and every few weeks it was in the shops for repairs. The stockholders supposed it was for use in inspecting roadway and bridges, and the repairs were, of course, charged up to the locomotive department.

The superintendent of motor power, old in the service of the company, and very old in years, had had the sermon on economy preached to him so long that it had finally made a deep impression. Every dollar that could be was gotten out of the power with as few repairs as possible, and, if an engine broke down, the failure was attributed to the engineman's negligence.

A short time before the traveling engineer's arrival on the line, the P. D. S. had bought eight new engines, which, upon trial, were found too heavy for the weak bridges to carry. The P. D. Q., which paralleled the P. D. S., saw here an opportunity to play the good Samaritan, and offered to exchange eleven old and smaller engines for the P. D. S.'s eight new ones, and the offer was accepted. These engines were accepted under steam and never did any good service. The traveling engineer had a practical and competent boiler-maker examine the boxes and stay-bolts. In every instance the box-sheets were condemned, and in one case 146 broken stay-bolts were found. The engines had to be returned to the P. D. Q. for new fire-boxes.

About the time that the transfer of engines was made, a similar exchange of 500 coal cars was made. The tonnage of the new cars had been increased over that of the cars formerly in use, and it was found that the new cars could not be loaded at the mines without incurring a heavy expense in alterations. So the good Samaritan exchanged old cars which had been condemned for the P. D. S.'s new ones. A coat of black paint was all that they needed before the line with an over-stock of relations put the old cars in service. The result was disastrous. Down on their side-bearings, they would not pull easily, and, consequently, the engine rating had to be cut.

As the two lines were owned by practically the same stockholders, and the P. D. Q. was making a favorable showing, while the P. D. S. was hardly holding its own, the two lines were merged and both put under the P. D. Q. management, thus breaking up the family circle of the P. D. S. A belt line was made of the two roads, empties were hauled over the P. D. S. and loads over the P. D. Q., and the earnings of the latter were much increased.

This humiliating downfall of the P. D. S. was directly traceable to the mismanagement and incompetency of relatives who were unable to deliver the goods. When a foreman gives a blacksmith a machinist's berth because the rate of pay is greater, it is a good thing for the family, but not for the company. Patents also often eat up dividends. For instance, the P. D. S.'s superintendent had a patent nozzle of his own design put in five engines. Although they proved a distressing failure on the road, the performance sheet was doctored to make them appear a success. They were of the "freak" order, but, of course, the superintendent would not believe that, and desired the traveling engineer's endorsement. Under the pretense of making a few minor changes in the drafting of the five engines, the traveling engineer removed the patent nozzles and substituted plain tips, and called upon the superintendent for a report of the tests made. That official, believing that he was boosting his own patent, paid a high compliment to the traveling engineer and showed up a remarkably fine record for the engines. The latter official, feeling that the time for action had arrived, resigned to accept a better position.

Moral: Protect your own interest and that of the stockholders first. If you have any relatives that you wish to

provide for, get them jobs on some other line, and let them work out their own salvation. JEUNE ECRIVAIN.

Modern Steel Frame.

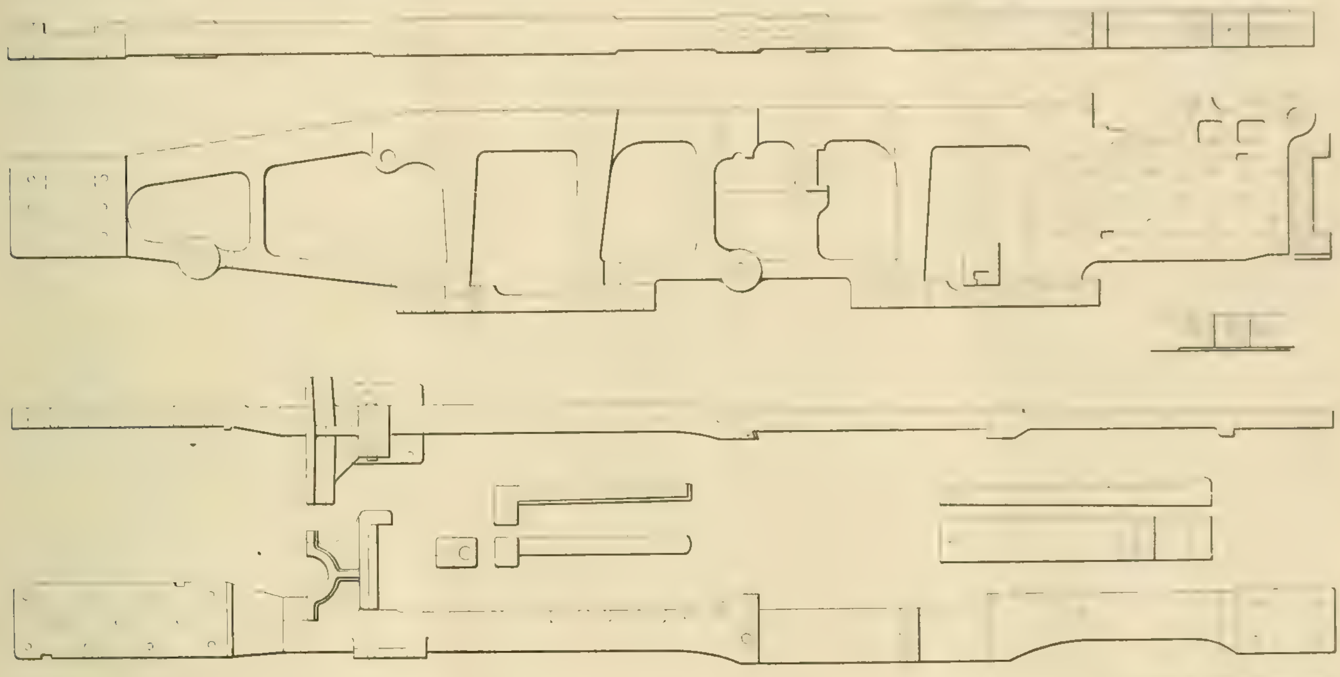
Through the courtesy of Mr. S. F. Prince, Jr., superintendent of motive power and rolling equipment of the Philadelphia & Reading, we are able to place before our readers a good example of a modern locomotive cast steel frame.

The frame is designed with a view of reducing the time required to machine it, and for this purpose bosses and planing strips are found only where necessary. The lower bar of the main frame has two circular bosses to hold the brake hanger pins; while the upper frame bar is pierced for the two front and back driving spring hangers, and has a notch for the gib of the spring equalizer post. A hole has also been cored out just above the frame splice for a stay which runs from smokebox to a point close by the lifting shaft bracket. The lower half of this lifting shaft bracket is cast on the main frame, thus saving the fitting and bolting of the brackets, a couple of studs holding the cap in place.

This form of construction lends itself readily to the designing of a very solid and substantial splice, both being flattened to plate form. Main frame and frame front are both bolted together with eleven 1⅛-in. bolts, and the plate portion of the "front" has a lip which comes against the end of the main frame and is let into it at the back end so that the shearing strain is taken off the bolts. Two keys passing through both, as well as the bolts help toward the same end. The frame front also has a curved offset, which would have been considered difficult to make with a forged frame One side of the rocker-box bracket and the flange for fastening the yoke are cast on the frame front and so require only the minimum number of bolts and studs and the minimum amount of machinery. The main frame bars are: Top, 5½x5 in.; bottom, 2¾x5 in., and the front is 5½x4 in.

The buffer beam or bumper is also made of cast steel cored out for lightness, but strong in form and securely tying the frames together at the head end. The yoke is also made of cast steel, bolted to the frame flange close to the rocker-box. In addition, frame and yoke are fastened together by a pair of dovetail strips on each side. In putting the yoke in place it is lifted above the frame flange and slides down into place, something like a window sash slides in its guides. The frame tailpiece is also of cast steel. It is of I-section, with two central tapering flanges at the end sec tions, parallel with the top and bottom flanges of the section. A rubbing casting is used with taper wedge and shoe, so that wear between engine and tender may be taken up. The shackle-bar pin passes through the center of the tailpiece, where the top, bottom and central flanges are thickened and modified in position to meet the requirements of the case. The pin holes are bushed to 2$\frac{9}{16}$ in., so that wear may be allowed for at all times and standard pins may be used. The lower flange is also thickened where the pull of the safety chains comes.

This steel frame and its attachments has passed the experimental stage. An engine with this frame has been running for some time and the design has proved itself thoroughly satisfactory.



CAST STEEL LOCOMOTIVE FRAME—PHILADELPHIA & READING RAILWAY.

Baldwin's Exceed All Records.

If they are not disappointed in their expectations the Baldwin Locomotive Works will by July 1 have turned out the greatest number of finished engines in any six months in history. The mark fixed by the officials of the works as the production for the six months is 1,000 locomotives, which is equivalent to two-thirds of the output for 1902, when more than 1,500 engines were turned out, breaking all former records.

For May the output was 190 machines, and the same number were turned out during April.

Of the 1,000 locomotives the great majority are on orders placed last year. The number taken this year will keep the works busy well into 1904.

The passenger department of the Illinois Central Railroad makes the announcement that "the daylight special, wide vestibule fast day train of the Illinois Central Railroad between Chicago and St. Louis, has become what the litterati would call 'an edition de luxe of a train.'" They make this and other remarks in a very neat little pamphlet which they have just got out, printed in colors on tinted paper. The illustrations, with full description, comprise the buffet-library smoking car, the parlor car, the dining car, the reclining chair car and the day coach, all of which may be found on the "Daylight Special." Mr. A. H. Hanson, general passenger agent, Chicago, will send this little booklet to those who apply to him for it.

Railway and Locomotive Engineering

A Practical Journal of Railway Motive Power and Rolling Stock.

Published monthly by

ANGUS SINCLAIR CO.,

174 Broadway, New York.

Telephone, 984 Cortlandt.
Cable Address, "Loceng," N. Y.
Glasgow, "Locauto."

Business Department:
ANGUS SINCLAIR, President.
FRED M. NELLIS, Vice President.
JAMES R. PATERSON, Secretary.

Editorial Department:
ANGUS SINCLAIR, Editor.
F. M. NELLIS, GEO. S. HODGINS, JOS. A. BAKER, Associate Editors.

Advertising Department:
Eastern Representative, S. I. CARPENTER, 170 Summer St., Boston, Mass.
Western Representative—J. A. BAKER, 1204 Monadnock Block, Chicago, Ill.

British Representative:
THE LOCOMOTIVE PUBLISHING CO., Ltd. 102a Charing Cross Rd., W. C., London.

Glasgow Representative:
A. F. SINCLAIR, 7 Walmer Terrace, Ibrox, Glasgow.

SUBSCRIPTION PRICE.

$2.00 per year, $1.00 for six months, postage paid to the United States, Canada and Mexico. For other parts of the world, $2.50, or ten shillings. Single copies, 20 cents. Remit by Express Money Order, Draft, Post Office Order or Registered Letter.

Mailing address can be changed as often as necessary—always give old and new address, and if you subscribed in a club, state who got it up.

Please give prompt notice when your paper fails to reach you properly.

Entered at Post Office, New York, as Second-class mail matter.

Grades, Profiles and Climbing.

On one occasion a sleeping car, running over a mountainous road was noticed, at one of the terminals, to have a heavy stain on the carpet in the aisle, just below one of the oil lamps, with which the car was illuminated. The lamps were in pairs, each in a handsome double-light brass chandelier which hung from the clearstory roof, and the oil used was of the best non-explosive kind—but there was the stain.

The porter in charge of the car was a quick-witted man and when asked for his explanation of the stain on the carpet, promptly replied that a new pair of wheels had been under one end of the car at the other terminal, and that the repair men there had jacked the car up so high at one end for this purpose that the oil had spilled out of the tilted lamp, and had thus most unfortunately spoiled the carpet.

The master mechanic at whose station the wheels had been changed, was equally quick-witted and quite truthful. He pointed out that when the car was jacked up, the angle of tilt was the same for all the lamps, and that therefore all of them should have overflowed and should have left a series of stains on the carpet instead of only one. He further called attention to the fact that the car had to be hauled over a 4 per cent. grade, and when going up or down this incline the whole car must be at a greater angle than it would be when jacked up for new wheels. A 4 per cent. grade is one in which there is a vertical rise of four feet for every horizontal hundred feet traversed. This car being about 70 feet long, had one end about 2 ft. 9½ in. higher than the other in going over this grade. It is obvious that wheels could be put in with less end rise than the grade produced. The porter was therefore asked to think again.

A railroad chain is 100 feet long and is composed of 100 links, each one foot long. When computing the rise of track on a grade the 100-ft. chain is supposed to be laid, not along the surface of the rising track, but to lie along a horizontal line, and the rise at the end of this railroad chain is the vertical height measured up from the horizontal. As a matter of fact the chain cannot be so laid in actual practice, but the computation is made as if it was. In fact, there is here supposed to be a right-angled triangle, in which the base is 100 feet long, the rise is the perpendicular, and the track lies along the hypotenuse of the triangle. The track on such a grade is therefore slightly longer than 100 feet. A 2 per cent. grade has a vertical rise of 2 feet in one hundred horizontal feet.

When a grade is represented on what is called a profile of the road, it is easy to see that if drawn strictly to scale, it would convey little or nothing to the eye. For example, if a one per cent. grade was represented with horizontal and vertical dimensions, each drawn to the same scale, say that of one inch to the mile, at the end of ten miles the rise, as shown on the paper, would only be $\frac{1}{10}$ of an inch.

It is usual, however, when drawing profiles to purposely distort the diagram. A scale for the horizontal or road distance is chosen, suppose it to be one inch to the mile, and the vertical height is then drawn to a very much larger scale, say one inch to 500 feet. This would make the vertical scale more than ten times that of the horizontal. This kind of distortion shows a rising or falling grade very distinctly, and is the reason why a profile of a railroad looks like the cutting edge of a large saw, with very irregular teeth.

The horizontal line for a profile is usually chosen far below the line representing the track at its deepest sags. Often the sea level or lake level is taken if the road is in the neighborhood of a large body of salt or fresh water. This horizontal is called the Datum line, and all verticals are measured up from it, and so figured on the profile. An example of a railroad profile was given in our June, 1903, issue on page 266. If one point is marked 200 feet above the datum, and a second is marked 300 feet, there is, of course, 100 feet difference in level between them.

In the matter of climbing a grade, an engine with a train of cars behind it is doing work which may conveniently be resolved into two components. There is the resistance of the train due to rolling friction along the level, and there is the work of lifting the train through a given vertical distance. The value of the resistance due to rolling friction along a level road is given by Forney as 6.6 lbs. resistance per ton (2,000 lbs.) weight of train, at a speed of 10 miles an hour. This value remains constant for that speed, whether the train be moving along straight level track or going up grade. This resistance, however, increases with increased speed.

The resistance due to the grade is something entirely different. On the 4 per cent. grade, of which we previously spoke, the total rise at the end of a mile would be about 211 feet, and each ton weight in the train would have to be lifted that distance. In this case the raising of the train is not done along the vertical line, like a bucket coming up out of a well. The pull of the locomotive on a grade is exerted through the horizontal distance of one mile. If one ton is lifted 211 feet while being pulled a mile, the rule which applies in finding the resistance per ton for the grade is "multiply the weight of the train in pounds by the ascent in any given distance in feet and divide the product by the horizontal distance in feet." Applying this to the case before us we have:

$$\frac{2000 \times 211}{5280} = 79.9 \text{ lbs.}$$

That is 79.9 lbs. resistance for every ton weight of train due to the grade. To this must be added the 6.6 lbs. per ton due to rolling friction at a speed of 10 miles an hour. The total resistance per ton which must be overcome to get a train up a 4 per cent. grade at ten miles an hour is 86.5 lbs.

In this calculation no account has been taken of curves or of wind resistance, or of slewed trucks with cutting wheel flanges due to poor center plates and side bearings. We have only considered a steady pull on straight track in good condition and in perfectly calm weather.

Observations on Inside Admission Piston Valves.

There are some advantages and some disadvantages connected with the piston valve having inside admission. To begin with the valve is perfectly balanced. Condensation is reduced because the live steam passing to the cylinders is confined in the center of the valve, and is protected by exhaust steam at each end, and this exhaust steam is warmer than the covers of the valve chamber, the

outer surfaces of which are in contact with the atmosphere. Such a valve is easy on valve stem packing, because the packing is only called upon to stand the intermittent action of the exhaust steam which is at a lower pressure and temperature than the live steam is. An accident to or a leak from either cover of the valve chamber would probably not be as serious as if the valve had outside admission. These piston valves are cheaper to make than the balanced slide valves. There being no steam chest jointed to the cylinder the chance of leakage from that source is eliminated.

On the other hand, this valve in common with all other piston valves, cannot lift off its seat like a slide valve can, and so relieve pressure of air caused in drifting, and being incapable of "giving" in any way it cannot make an emergency escape, for water if any gets into the cylinder. When water finds its way into a cylinder whose steam admission is governed by a piston valve, there is generally trouble for the round-house staff sooner or later. The inside admission valve has also to sustain a series of shocks from exhaust steam. As each exhaust leaves the cylinder and enters the valve chamber-end, it tries to push the valve to the other end of the chamber, and the fact that the valve is perfectly balanced, allows the full force of the exhaust steam to find out any lost motion that there may be in the valve gear, and this lost motion is shut up by the forward exhaust and drawn out by the back exhaust, with consequent increased wear of parts. The smaller the exhaust nozzle used the greater the force of the exhaust shock on the valve, and when the engine is working hard with very little expansion, the force of the shock may be considerable. At any rate, its cumulative effect is what has to be reckoned with by the repair staff.

The "Overlap" and the "Chalk-line" Stop.

In automatic block signaling the expression "overlap" is employed to indicate a certain arrangement of track circuit used in working the signals. In ordinary practice, a train entering a block immediately causes both the signals at the entrance of that block, say at A, to go to "danger." When the train leaves the first block and enters the second, the signals at B go to danger and the home signal at A assumes the all-clear position, indicating that no train is in the first block. Now, with the "overlap" in use, the train in question would have to run a certain given distance past signal B (say 600 feet or more) before the home signal at A would "clear." That distance is called the overlap.

The question as to whether or not it is advisable to use the "overlap" with automatic signals was discussed at a recent meeting of the Railway Signaling Club. The arguments, pro and con, amount briefly to this: The advocates of the overlap regard it as an additional precaution or safety device, while those opposed to its use think it introduces an element of uncertainty and that it gives incorrect information to the man on the engine.

Regarding the use of the overlap a very pertinent question was put by one of the speakers in which he practically asked, would you feel perfectly safe if you were sitting in the rear end of the last car of a train which had just passed out of block A by a few feet and was halted there with signal B standing at danger almost over your head? The train following would, as the limit of safety, have to make a "chalk-line stop" at signal B in order not to crash into the rear of your train. Can the man on the following train be relied upon under all circumstances, on good or bad rails, in clear or foggy weather, with efficient or indifferent brakes or hampered by the thousand-and-one variations which may arise to mar the "chalk-line stop"—can he be depended upon absolutely every time?

The advocates of the overlap answer this question in the negative, and say that safety demands that your train should not have "cleared" the home signal at A until you were well into block B and far enough past signal B to enable the following train to stop at or near the home signal B, with the chalk-line element in the stop left out, because not always possible of realization. They say the overlap takes care of an occasional or unintentional run-by. They point to the use of derails on railways as proving that officials are doubtful concerning ordinary discipline, and the fact that the derail does claim its victims shows that the chalk-line stop is not invariably made.

On the other side, the argument is that even if you were just in block B with the signals almost above your head showing danger, and the home signal at A standing at "all clear," thus permitting a fast train to enter the block you had just left, you would not be in danger, provided the rules had been observed. The man on the high-speed train following knows when he passes A that the home signal at B is against him. He knows this because the distant signal at A works in unison with the home at B, and when he passed the post at A he was told as distinctly as semaphores can say it, "The home signal at B is against you, prepare to stop now."

The practice of flagging a following train from the back platform of the last car which was more fashionable formerly than now, has been found to be dangerous, simply because the flagman had not gone back far enough, but the home signal at B cannot be accused of following that method when it has a flagman in the shape of the distant signal back the full length of the block, and showing the caution indication on the post at A.

The caution signal at A gives a man one whole block to provide for the thousand-and-one variations which arise and militate against the chalk-line stop which he may have to make at B. The overlap practically gives him one more chance in case he miscalculates or is somewhat slow of action.

These are practically the arguments one way and the other which were brought out at the meeting of the club. What we would like to hear now are the opinions of motive-power men of all grades concerning the use of the overlap. The columns of Railway and Locomotive Engineering are open to those who have something to say on this important subject. What do the men who watch for these signals through the cab windows think of the overlap? What have they got to say regarding the imperative and invariable chalk-line stop? The motive-power men have the floor!

Reckless Use of Gasoline.

As gasoline is the liquid from which the explosive mixture is made that is used in the driving of gas engines, nearly everybody understands that it is an explosive mixture and, therefore, ought to be treated carefully with lights or heat that would ignite the gas emanating from the gasoline. Gasoline is not explosive until its vapor is mixed with a certain proportion of air, but when that is the case it is just as explosive as gunpowder. Everybody connected with machinery nowadays ought to be familiar with these facts; but there still remains a great amount of ignorance among those who are supposed to know.

In New York last month there was an explosion connected with a boiler which is likely to result in the death of several persons and we cannot imagine anything more reckless than the act which caused the explosion. A steam boiler used in the basement of a 7-story apartment house had been getting foul with lime scale from the feed used, and the engineer in charge of the boiler with the help of the porter undertook to clean out the scale with liquid gasoline. They pumped a large quantity of gasoline inside the boiler and waited a short time to give it a chance to act on the scale; then the engineer becoming inquisitive as to how the gasoline was working on the scale took a lighted candle and held it inside with the view of examining the condition of the boiler. A terrific explosion followed in which the two men were very seriously injured.

Book Reviews.

The American Steel Worker. By E. R. Markham. Publishers: The Derry-Collard Company, New York. 1903. Price, $2.50.

The author, who has had twenty-five years' experience in the selection, annealing, working, hardening and tempering of various kinds and grades of steel, is competent to fulfil the task he has undertaken. The work, which has just left the press, is a book of 316 pages, illustrated by numerous line cuts. It is not divided into numbered chapters in the conventional way, but the paragraphs are headed in bold type and the comprehensive index at the back supplies the student with an admirable reference table.

Mr. Markham tells how to do things and why they should be done in a certain way, and he calls attention to things to be avoided in the manipulation of steel. It is a thoroughly practical work and demolishes the idea of so-called "luck" which many hold to regarding the treatment of metal. The book tells how to know steel and how to select it, and what variety of steel is best suited for some particular use. It explains how to work steel in the making of small tools, taps, reamers, drills, milling cutters, also about the hardening and tempering of dies large and small; about pack and case hardening; tempering springs; how to anneal; what sort of apparatus to use and how to make it. The mixtures for baths are given and all in the book is written in the plainest way possible.

The Car Builders' Dictionary, 1903 Edition. New York: Published under the direction of the Master Car Builders' Association by *The Railroad Gazette*. Price, $5.

This dictionary, which has long been a standard reference book for all those who are in any way connected with or interested in the rolling equipment of railroads, has been re-written, re-engraved and brought up-to-date in every respect. The new edition contains 525 pages and 4,971 illustrations of cars and parts of cars, showing practically every standard type of freight and passenger car, and the details of their construction. In general arrangement the lines of the 1895 edition have been followed, the book being divided into two general parts, the first 151 pages containing definitions, historical matter and specifications, and the last 374 pages containing the illustrations. In the illustrated pages are shown, besides the numerous types of cars and their details, trucks and truck details, car furnishings, electric cars and trucks, together with the electrical machinery placed on them, the standards and recommended practice of the Master Car Builders' Association, and car shop machinery. The subject matter in each of these divisions has been grouped together and arranged under sub-headings in alphabetical order. With this arrangement the finding of the illustration of any part becomes a simple matter.

The Baldwin Record of Recent Construction No. 42 has just come to hand. It is a reprint of the paper read before the Mechanical Engineering Societies of Columbia University, New York, and Lehigh University, South Bethlehem, by Mr. Lawford H. Fry, of the Baldwin Locomotive Works. It is a study of the steam distribution of the Vauclain compound. The subject is fully covered in Mr. Fry's paper, and is well illustrated. Half-tones of the cylinders and valves are shown and a section through cylinders and valve chamber is given. At the end of the pamphlet there is a valve diagram constructed on Zeuner's method, and accompanying this is a series of colored sections in which the various positions of pistons and valves are graphically represented through an entire cycle with live steam, exhaust steam, steam expanding or being compressed, all shown by different colors or intensity of color. The Zeuner diagram and the colored sections are printed on a folded insert which is fastened to the back cover in such a way that when spread out they lie before the reader beyond the printed page, so that they may be seen without the vexatious arrangement which usually compels one to turn over several pages in order to refer to the diagram or chart about which one is reading.

Don't Abuse the Monkey Wrench.

Among the papers read at the meeting of the American Society of Mechanical Engineers, held at Saratoga in June, was one on "Strains Produced by Excessive Tightening of Nuts," by A. Bement, a member of the society. The gist of the paper is in the first three sentences which read:

"In the design of machinery, ultimate strength, elastic limit and deflection of parts usually receive careful attention; but with prevailing practice and methods of erecting machinery in final place, there is but little assurance that damage may not be caused by ignorance or carelessness on the part of the erecting crew, owing to excessive tightening of nuts and screws, which may, and often does, result in straining bolts and parts beyond their elastic limit. There appears to be no rule in general use for the guidance of the men who perform the work of machinery erection, and it seems usually to be their desire to make things as tight as possible. The natural result is that elastic limits are often exceeded or that breakages may even occur."

These are facts which the machine shop apprentice sometimes learns with humiliating impressions. There is no rule for tightening up nuts any more than there is for pushing a file; but experience teaches how to do the work right. We believe there are many members of the American Society of Mechanical Engineers who never worked in a machine shop, and the information imparted by this paper will, no doubt, prove useful to them, if they should ever undertake to handle a monkey wrench.

In some men's hands, the monkey wrench is a most destructive tool. If its handle was a yard long, they would exert the full leverage combined with their own brute force when screwing up a nut. The cutting tongue of the foreman sometimes imparts timely reproof to the man who wields wrenches without judgment, and we incline to think that the discipline thus given is likely to be more salutary than papers presented to engineering societies.

If the writer of the paper referred to had known of the practice, he might have told that it is a bad thing to twist off the stud of a cylinder head by exerting the combination of strength and stupidity; and the case is made worse when the workman sticks the stud in place by bedding it in white lead. There are a great many bad practices common in some machine shops which could be ventilated in a shape that would make interesting reading. They would also give the writer an excuse for presenting his name to an engineering society.

Acceleration Tests on the Great Eastern Railway of England.

In our April issue we illustrated and described the heavy suburban "decapod" designed by Mr. James Holden, the locomotive superintendent of the line. It will be remembered that this is a three-cylinder simple engine with 18½x24 in. cylinders and 54-in. driving wheels.

It was designed to attain a speed of 30 miles per hour in 30 seconds after starting, with a load of about 315 tons of 2,240 pounds each, behind the tender. An electric testing apparatus was recently installed on the main line at a convenient locality, and the up and down line were each equipped.

The recording mechanism, which was placed in a cabin beside the track, consists of a ribbon of paper which is drawn over a roller at a uniform rate of speed. A battery actuating an electro-magnet has contact made and broken by the pendulum of a clock so arranged that a marker dots the paper at regular half-minute intervals. A track circuit is also arranged connected with a marker which dots the paper tape along a line parallel with the half-minute dots. In order to operate this acceleration recorder, a series of copper plates are placed beside the track and over these passes a contact brush carried by the engine, which makes or breaks the cir-

cuit according as the brush touches or leaves the copper plates.

The copper plates are spaced along the track at the correct though increasing distances apart, which, if the acceleration be just as expected, would cause the marker to dot the paper every half minute. If, therefore the series of time dots and the series of acceleration dots were exactly equally spaced on the paper, it would prove that the engine was gaining in speed as desired.

In the test which was recently made the weather conditions were not favorable, as a high wind was blowing at the time. The engine had 20 long tons more than her load, and was drawing a new train which did not run easily. In spite of these disadvantages she showed an acceleration of 1.4 feet per second. The acceleration necessary to get up to 30 miles an hour in 30 seconds is 1.46 feet per second. It was therefore believed that when conditions are normal the full acceleration will be achieved.

The result obtained was in a special though severe test, but the engine has yet to undergo the trying and continuous test of daily service with probably 15 stops for passengers in a distance of ten and a half miles. The engine weighs about 156,500 pounds, and though she may develop the acceleration required, her general appearance would lead one to fancy that her maintenance charges will be heavy if she stands up to the hard work cut out for her.

Another "Balanced Locomotive Company" has been organized, this time at Pierre, S. Dak., capital $1,000,000. We do not suppose the organizers of the Balanced Locomotive Company could possibly get a specimen of their machine built in an ordinary contract shop. We are moved with anticipation to see this newest balanced locomotive. So many of them are reposing in the graveyard of good endeavor or have been used as good intentions to pave a place which shall be nameless that we hanker with great hankering to see a new specimen.

The Watson-Stillman Company's catalogue No. 65 has just come to hand. It is their illustrated index for 1903. The last issue they made of such an index was No. 51, several years ago, and it contained 44 pages. The present issue has 72 pages, which shows the numerous additions in all departments which have been made to the list of tools and appliances manufactured by this well-known concern. Jacks, punches, hydraulic presses, pumps, riveters, valves, polishing lathes, etc., etc., are all illustrated in endless variety and are named and numbered. Write to the Watson-Stillman Company, 204 East Forty-third street, New York City, if you wish to obtain a copy.

QUESTIONS ANSWERED.

(42) R. Y. S., Albany, N. Y., asks:

What repair shop accommodation ought to be provided for a railroad having 100 locomotives? In ordinary districts where the feed water is not particularly bad provision ought to be made to have 10 per cent. of the engines undergoing repairs all the time. About 2 per cent. may be light repairs which can be done in the round houses. About eight repair shop stalls ought to be provided for one hundred locomotives.

(43) Inquirer, Cincinnati, asks:

What is meant by the expression split calking? A.—It consists of driving a thin calking tool, about 1-16 inch thick, against the edge of a sheet so that a thin section of the sheet is driven in between the two sheets to make a tight joint. The result is that the plates are separated from the edge of the lap back to the line of rivets. It is a quick and bad species of workmanship and is in vogue principally where piece work is not subjected to rigid inspection.

(44) Fireman, Cheyenne, Wyo., writes:

Please give me a plain rule for setting eccentrics on the road in words that it does not need a college professor to understand. A.—We certainly think that the directions given in Thompson, Conger, Sinclair, McBain and other books are simple enough. The instruction given in any of these hand books ought to be satisfactory. We also recommend an article by J. W. Reading on page 253 of our June issue.

(45) R. P. M., Albany, N. Y., writes:

In Mr. Sinclair's article on the "Growth of the Locomotive," he says on page 248 of the June number that John B. Jervis had a locomotive built with a four-wheeled truck, the first of the kind, which was called "Brother Jonathan." I am familiar with the history of early locomotives, and I have always heard Jervis' first engine called "The Experiment." Has not Mr. Sinclair made a mistake? A.—We know that the popular name for the first Jervis engine was "The Experiment," but Jervis himself in a book which he wrote on railroads, which is before us, said that he called the engine "Brother Jonathan." He ought to be the best authority on such a question.

(46) R. J., Walkerville, writes:

Will you please explain why engines equipped with piston valves, pound so badly while drifting. An engineer on a neighboring road told me that they had instructions to drop the lever in the corner after shutting off. There are a few Brooks engines here with piston valves and there are printed instructions in the cab not to drop the lever more than half way to corner. A.—With outside admission valve, when engine is drifting, the valve is moving as it does when steam is used and air is being sucked in behind the piston and is being pushed out before the piston into the exhaust cavity. When the valve reverses its motion and travels forward while the piston is still moving back, there comes a time when the piston valve entirely closes the port through which the air is being pushed into the exhaust cavity. It is while the port is closed that the air in front of the piston cannot get out because the piston valve cannot lift off its seat. The sudden stoppage of the flow of air out of the cylinder, and its consequent compression takes up all the lost motion in either the little end, big end or driving box and develops a pound. Lost motion in any of these places which would hardly be discernible in an engine with slide valves, is distinctly noticeable with a piston-valve engine. The nearer the reverse lever is to the corner, the closer the piston will be to the end of its stroke before the port closes, and when the lever is in the corner the port closes so late that there is not much air left to compress in the cylinder and consequently the pound will be lighter. Dropping the reverse lever to the lowest notch does not necessarily remove the pound altogether though it lessens it. At high speeds if you drop the lever down to the lowest notch, the chances are you cannot draw it up again until speed has slackened and time has been lost. In any case the sudden alteration from short to long travel is hard on valve gear, and many roads advise dropping the reverse lever to the corner by easy stages. Make a card model of cylinder and valve and work it out yourself.

(47) A. N., Chicago, writes:

(1) Will you please give your opinion which is the more correct way of comparing horse power? In the usual way, 33,000 lbs. one foot high in a minute, or the European way, in meters and kilograms, figuring 75 kilograms one meter high in a second as a horse power. A.—The horse power in Great Britain and in the United States is 33,000 lbs. raised one foot high in one minute, or its equivalent. For example, 550 foot-pounds per second is a horse power. A kilogram is equal to 2.204 lbs., 75 kilograms would therefore equal 165.3 lbs., and that weight raised 39.37 inches or one meter in a second would be somewhat less than a horse power. It does not matter how you state horse power, but to be correct it must be strictly equivalent to the sum of the three definite factors of weight, distance and time, or it is not a horse power.

(2) Would you please give the most correct way of figuring the resistance of a train at different rates of speed, on level and straight track, also on up grades with straight track and with curves. A.—Forney answers these questions in the *Catechism of the Locomotive*, page 585.

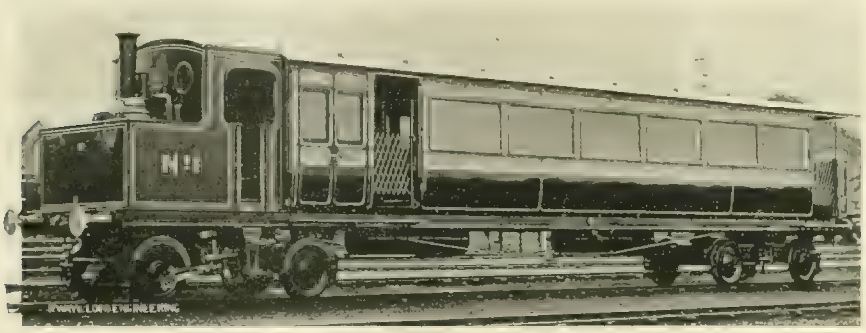
which see. He says, "It has been found that it takes from 4 to 6 lbs. per ton of 2,000 lbs. to move a car slowly on level and straight track after it is started." The resistance increases with the speed, for 10 miles per hour he gives a resistance per ton of 6.6 lbs., 15 m. p. h. gives 7.3 lbs., 20 m. p. h. gives 8.3 lbs., 25 m. p. h. gives 9.6 lbs. and so on. For resistance on grades, read the article on Grades, Profiles and Climbing in the current issue of RAILWAY AND LOCOMOTIVE ENGINEERING. With reference to resistance due to curves, Kent's rule is 0.5 lbs. per ton of 2,000 lbs. per degree of curve. Many of these questions involving formulas can be answered by referring to some standard Engineers' pocket book.

(48) F. B. H., Philadelphia, asks:

What may go wrong with the air operated blow-off cock and top check which will prevent it closing? A.—It may be that some scale gets on the seat of the air operated valve and holds it open, and if the opening of this valve be sufficient the check valve will be held open and steam and water will blow through. To remove the piece of scale, open and shut the air operated valve several times as quickly and as widely as possible. A sudden gush of water may carry it out. If the air operated valve will not close and appears not to be held open with scale, it is possible that the cylinder containing the air piston may have been subjected to the "soft-hammer treatment," and a dint or dinge in the thin brass walls will prevent the proper movement of piston. If the case is not very serious the piston may be made to travel up and close the air operated valve, by screwing the nut on top out as far as it will go. If this cannot be done the valve needs overhauling.

(49) V. D. W., Enbank, Ky., asks:

In building locomotives what provision is made for the change in the distance between wheel centers due to the wheels getting out of line in running over uneven track? The length of a line drawn through the centers of the three crank pins of an ordinary mogul is longer when the middle wheels drop down into a low place in the track, than when all wheels are standing on a straight rail. A.—In the first place the side rod is jointed close to the main crank-pin, so that the lowering of the center wheel in your mogul, causes the two ends of the side rod to make a very slight angle with each other. The blue print of a modern 2-6-0 engine is before us, with distance between leading and main drivers given as 7 ft. 2 in. and that between rear drivers 8 ft. 6 in. Taking these rod ends as the radii of two circles, it is easy to see that any slight lowering of the main pin such as would be caused by a track joint, would produce so slight a difference in length of these lines as to be practically of no importance. The rod end, seven or eight feet long, lies on the hypothenuse of a right-angled triangle, whose base is the theoretically horizontal line between their center lines, and the vertical distance through which the middle wheel has gone down, may be, perhaps, ¼ of an inch. In such a case the difference between the length of the base and of the hypotenuse is so slight that it may be disregarded. The pins and brasses, and the driving boxes, wedges and shoes are not so closely fitted as not to be able to help in the necessary adjustment. An engine fitted up so "snug" that it could not "give" in various ways would run too hot to be of service on the road.



STEAM PASSENGER CAR—LONDON AND SOUTH WESTERN RAILWAY.

Motor Coach.

Our illustration shows a motor coach recently designed and built by Mr. D. Drummond, locomotive superintendent of the London and South-Western Railway. The length of the frames is 56 feet, and it carries the car, built to seat ten first-class and 32 third-class passengers, and a luggage compartment capable of holding ten tons. The car is carried on two four-wheel trucks, one of them being the motor truck. The cylinders of the motor are 7x10 inches, and it is intended to attain a speed of 30 miles an hour in 50 seconds after the start. We have not received any particulars about the actual tests of the car, but we are inclined to think that it will come considerably short of the speed for which it is designed. The intention is to use cars of this kind on branch railroads. The designer thinks that the small motor will save considerable dead weight that accompanies the use of a locomotive.

Convention Men Like to Go Fishing.

Wherever railroad men and those who supplied things to railroad men met together during the early part of June, many congratulations have been heard about it not being necessary to make a trip to Mackinac to attend a mechanical convention. Others, however, have displayed disappointment at being prevented from attending the place where the waters from the greatest lake in the world pass through a narrow channel in their way to the sea. There were visions of fishing and many of the men who go to the conventions annually live where there is very little water in sight, and consequently they have double desire to sit on the bank of a pellucid stream.

It is wonderful the amount of patience which some railroad men and their friends display when they sit with a fishing rod in their hands. To be sure, it gives them an opportunity to fabricate amusing stories which last them the year round, and no one ought to deny them this innocent kind of amusement. A story is told of one of these earnest fishers who was sitting beside a stream which ran under the walls of the ground of a lunatic asylum. He was sitting patiently in the sun without a murmur and had been there for several hours when an inmate from the other side climbed to the top of the wall and began to question the fisher. "What are you doing there?" says the lunatic. "Fishing," says the master car builder. "How many have you caught?" says the lunatic. "None," replies the master car builder. "How long have you sat there?" says the lunatic. "Four hours," says the would-be fisher. "You are in the wrong place," remarks the lunatic, "you ought to be at this side of the wall."

The Roberts Steam Piston Packing Company, of Philadelphia, have lately received some gratifying testimonials from users of their piston packing. The Youngs Amusement Company and Youngs Pier plant at Atlantic City say that they find the increase of power and the saving in fuel over the old style packing is 17 per cent. The Merchant and Miners' Transportation Company, of Baltimore, say that during the past ten years they have put in seventeen of the Roberts rings, and have always found them to be satisfactory. George F. Sloan & Brother, manufacturers of flooring, Baltimore, say they have used the packing for years, and are glad to recommend it. The Standard Brewery Company, of Baltimore, say they have used this packing for eight years, and recommend it to any one using an engine. The company will be happy to give any information asked for.

Air-Brake Department.

CONDUCTED BY F. M. NELLIS.

Air-Brake Conditions Reported by the Interstate Commerce Commission.

The report of the Interstate Commerce Commission for 1902 gives some very interesting information in the matter of air-brake maintenance on railroads. The ten inspectors employed by the Commission examined 167,371 cars. Of this number 1,365 were found to have defective retaining valve pipes; or, in other words, 2.48 per cent. of the cars examined were defective in this respect. Likewise the cylinders and triple valves not cleaned in prior twelve months were 7,670 in number, or 13.93 per cent. The cases of date of cleaning cylinder and triple valves omitted on examined cars were 3,428, or 6.21 per cent. From the total showing, the defects reported each month, it appears that the larger number of defects were reported during the months of January, February, March and April. This is doubtless a good indication that railroads have generally adopted the practice of placing their air-brake apparatus in shape as far as possible during the spring and summer months, expecting them to last the year out.

Following are some of the conclusions drawn by the Commission regarding their findings in the inspection of air brakes during the past year:

Results of Systematic Inspection.—The report of the chief inspector shows that the ten inspectors employed by the Commission examined 161,371 cars, as compared with 98.624 examined by the smaller number of inspectors during the year before. The number of cars on which one or more defects were found was 42,718, as compared with 19,462; the percentage found defective was 26.47, as compared with 19.73. This condition is due, not to worse conditions, but to the more systematic inspection of air brakes.

Too Frequently Blamed on the Air Brakes.—Uncoupling mechanism continues to be the most unsatisfactory feature of the coupler situation. A chain too short will uncouple a car in motion, and this is a probable cause of disastrous wrecks.

Should Use All Air Brakes in Train.—The situation as regards the use of power brakes on freight trains has improved during the past year. The percentage of air-braked cars used in trains is greater than a year ago, but it still is in a large part of the trains too small, and the use of hand brakes as the main or only means of regulating speed on steep descending grades continues on some important railroads. The letter of the statute is complied with when the engineman controls the brakes on enough cars in a train to control it and to stop it within a reasonable distance. This may be from 25 to 75 per cent. of the cars, according to the condition of the brakes, the weight of the cars, braked and unbraked, and their lading, and the gradients of the line. But the statute contemplates—in spirit at least—the general use of power brakes on all the cars of every train. This full use is the prevailing practice on the railroads in the West, where air brakes have been longest used on freight trains, and it is in accordance with the teaching of those who are expert in the management of air brakes.

More Yard-Testing Plants Needed.—The absence of adequate and suitable inspection and testing facilities at large freight yards is still to be remarked on some of the most important railroads. Bearing in mind that the air brake is a delicate apparatus, and that therefore inspection, cleaning and the maintenance of tight-jointed pipes are vital elements in safe and satisfactory service, this lack of yard plants calls for particular attention.

Iax Discipline and Neglected Practice.—The inspectors' reports show, as they did a year ago, inefficient practice in the use of air-brake defect cards; lax discipline, permitting trains to be pulled apart when the brake-hose connection has not been separated; and very general neglect of the retaining valve.

Air Brake, if Coupled up, Would Prevent Destruction.—There is one class of casualties to trainmen, those due to freight trains breaking in two, in which both the couplers and the brakes usually figure in the statement of causes. The parting is due to some fault in the coupler, but in compiling this information it appeared that most of the derailments which result from this cause are aggravated by the automatic action of the air brake; and this automatic action causes damage chiefly because a part of the cars in each train have no air brakes, or have air brakes which are not connected to the engine and so are not used.

More Strict Legislation Suggested.—To promote a more general compliance with

ECHOES OF THE COLORADO SPRINGS CONVENTION OF THE AIR-BRAKE ASSOCIATION. THE LADIES OF THE CONVENTION FORMING THE NOW FAMOUS "BURRO BRIGADE." BY COURTESY OF MRS. JOHN HUME, JR., HOUSTON, TEXAS.

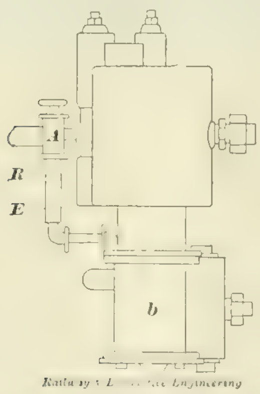
the spirit of the safety-appliance law in the use of air brakes, the Commission recommends the passage of an act forbidding the running of trains in which less than one-half of the cars are equipped with power brakes in operative condition and suitably connected to the engine, and empowering the Commission to issue a general order or orders requiring the use of power brakes on more than 50 per cent. of the cars in a train, as and when it shall find such increased use to be practicable, the percentage to be specified in the order or orders.

Leniency Extended in Deserving Cases.—The belief has been expressed in some quarters that such an act should also authorize the Commission, in the case of any particular road, and after due hearing and investigation, to issue an order permitting, for a specified limited time, the running of trains with power brakes in use on less than 50 per cent. of the cars therein; and that such orders should be authorized to prevent any possible hardship due to unforeseen exigencies.

Important Air-Brake Experiments Abroad.

Another experiment with the Westinghouse air brake has been made in England, says the *Electrical Review*, for the purpose of solving the problem of controlling freight trains traveling at high speeds on steep descending grades. The North-Eastern Railway Company recently conducted a series of important trials on its lines, which at one point attains an elevation of 1,800 feet above sea level, and is one of the steepest sections of railway in the United Kingdom.

Forty heavy coal cars comprised the train, each car being equipped with Westinghouse rapid-acting brake apparatus, the



AUTOMATIC OILING DEVICE FOR AIR CYLINDER OF AIR PUMP MOUNTED ON PUMP.

air pressure being operated from the engine. Despite high speed, unfavorable climatic conditions and traveling on the down grade, the train was brought to a stand in a very short distance, the application of power on both front and rear wheels of the train being practically simultaneous.

The trials were conducted under the supervision of the leading officers of the North-Eastern Railway and representatives of the Westinghouse Brake Company, and are said to have been highly satisfactory.

ANOTHER ECHO OF THE AIR-BRAKE CONVENTION. ADMIRAL AND COMMODORE OF THE "FLEET." COURTESY OF MRS. JOHN HUME, JR.

Break-in-Twos Due to Burst Hose.

Some years ago when trains breaking in twos gave a great deal of trouble, the cause was commonly assigned to the bursting of air hose. In recent years, however, the cause has been shifted to defective uncoupling parts of the automatic coupler, where it undoubtedly more properly belongs. It has been found in many cases in every-day service that too short a chain is frequently placed on the coupler in making repairs, and when the train gets in motion and the draft springs are compressed, the short chain will cause the coupling pin to be lifted and the knuckle to become uncoupled. Doubtless a great many break-in-twos are wrongfully placed on the air brake, when they should be more properly assigned to short uncoupling chains.

Since the defective parts of the knuckle coupler have been found to be guilty of many of the faults commonly placed on the air brakes in the matter of trains breaking in two, the question has been raised as to whether undue importance was not attached to the bursting of air-brake hose in years past. A close observer has noted that a rent in a burst hose usually extends no further than ½ or ⅝ of an inch in length. He has also called attention to the fact that in his opinion this opening, at such a remote point from triple valve, would not produce quick action in trains of any considerable length. Indeed, he has gone so far as to attempt to duplicate these conditions, by cutting a half-inch slit with a penknife in the hose, and binding it with a piece of sheet rubber and twine, making it temporarily tight. After charging this hose with pressure, he suddenly cut the twine binding, thereby producing as close as possible the conditions of bursting hose, but the air which escaped in the experiment was insufficient in any case to produce quick action on a train of two cars. It would seem, therefore, that much of the blame due to bursting hose has been wrongfully placed in years past. It will be noted also that burst hose is very seldom nowadays reported as causing break-in-twos and consequent damage due to the quick-action application of the brakes. Defective automatic couplers and their uncoupling parts are by far much greater offenders.

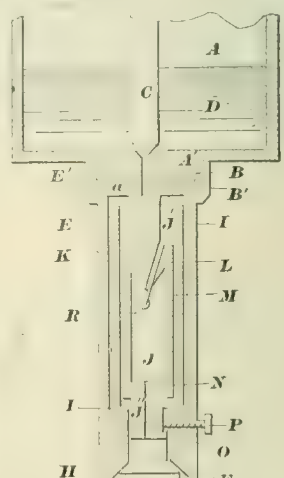
CORRESPONDENCE.

Automatic Oiling Device for Air Cylinder of Air Pump.

Fig. 1 is a side elevation of an air pump with my automatic oiling device applied thereto.

Fig. 2 is a central section of so much of my oiling device as illustrates my present improvement.

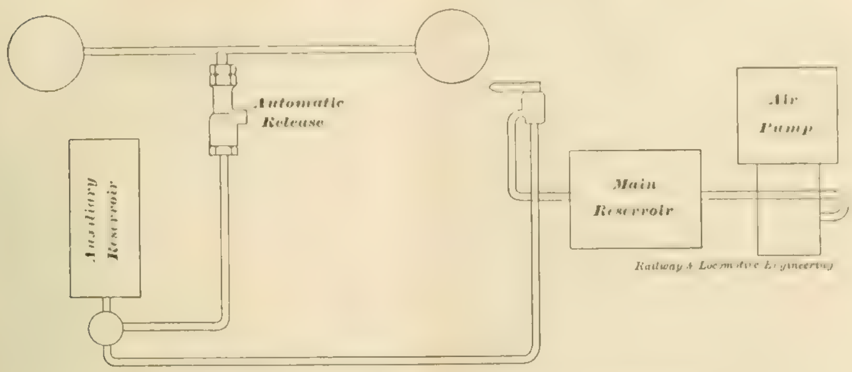
In the drawings *A* is the oil cup or reservoir having port *B* in the bottom thereof. *C* is the ordinary regulating screw by means of which the flow of oil *D* through port *B* is controlled. Surrounding port *B* is a boss *A'*, which is exteriorily threaded and screws into the



DETAILS OF AUTOMATIC OILING DEVICE FOR AIR CYLINDER OF AIR PUMP.

enlarged top *E'* of the tube *E* upon plate *a* to hold said plate firmly on its seat in said tube. This plate has a boss through which and through the boss is a port *B'*, which is a continuation of

port B. In the lower portion of tube E is the downwardly opening check valve F, which permits the oil to pass down in the tube whenever a vacuum or partial vacuum is produced in the upper part of the air compressor b. It is held



FARRAR'S RELEASE VALVE. DIAGRAMMATIC VIEW.

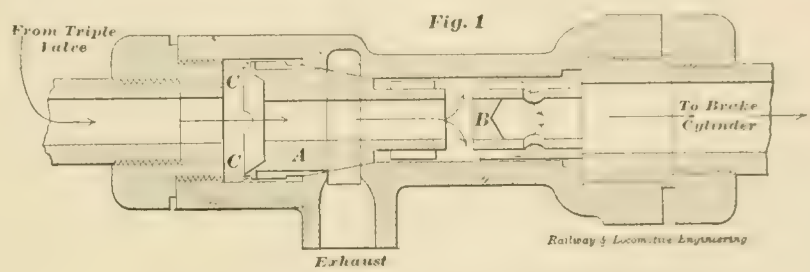
normally closed or seated by spring G. The opening through tube E is constricted at and just above the check valve. The lower portion of this constricted portion forms a valve seat H for the check valve and the upper portion thereof forms a support for the glass sight tube I, whose lower end has grooves I' extending there through so that air may pass under the sight tube as well as over the top thereof, as I have found by experience that if all the air comes over the top of the sight tube the oil is sometimes blown into a spray instead of dropping, as it is better for it to do so that the engineer may be able to see just how fast the oil is being fed into the compressor. The external diameter of this tube is about $\frac{1}{32}$ of an inch less than the internal diameter of tube E. Resting upon the top of the check valve is feed needle J, having a cylindrical stem J' at the top adapted to close port B when the check valve F is seated so that no oil will flow out of the reservoir when the compressor is running.

At the base of stem J' is a circular groove K having an opening L in the bottom thereof. In this opening L drop a small wire M which guides the oil passing through the opening and causes it to drop in smaller drops than if it were not used. It may be omitted if desired, but I prefer its use because I prefer to have the oil dropped in small drops. The lower portion J'' of the feed needle is also cylindrical. In this portion of the needle is a groove N which permits the oil to pass down to the check valve. A recess O is provided in the side for the reception of the end of screw P, which prevents the feed needle from rotating, thereby enabling the end of wire M to be seen through sight port R in tube E.

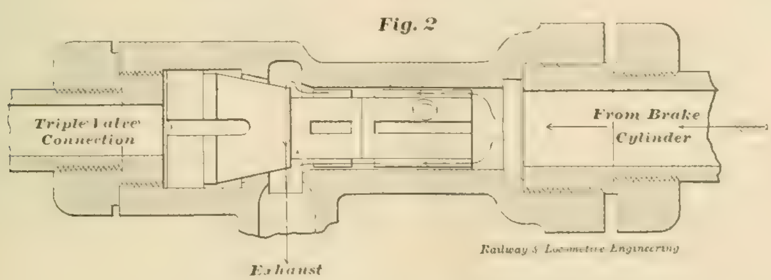
This screw could be placed so that the end thereof would enter groove N and the recess omitted. By this improvement, should the compressor stand idle, the oil is automatically shut off from the reservoir until it is started up again, thereby economizing the use of oil. If desired, the feed needle could be made integral with the check valve, thereby forming stem on the face of the check valve which would close the port when the compressor was not running.

G. W. THURSTON.

Dunsmuir, Cal.



FARRAR'S RELEASE VALVE, BRAKE APPLYING.



FARRAR'S RELEASE VALVE, BRAKE RELEASING.

New Release Valve.

I am sending you a blue print of my automatic release valve, which I think will fully explain its construction and action.

The parts A and B are movable, and are shown in Fig. 1 in the position they occupy when the brake it set, the conical valve having closed off communication with the atmosphere. Fig. 2 shows them in release position, and the arrow lines indicate the flow of air to and from the brake cylinders. A pipe is attached to the exhaust passage and carried into the cab, and a cut-out cock put on the end, convenient to the engineer. When this is closed the valve is cut out and the air from brake cylinders pass along the grooves C and through the triple valve exhaust. The grooves are made equal to the area of the exhaust port in the triple valve. The grooves in the blue print are not correct, and should only extend as far as the commencement of the conical seat in the body of the valve.

J. FARRAR.

Montreal, Can.

Concerning Oiling of Air Pumps.

Regarding Robert L. Stamp's question in May number, I would say that I think the 8-in. and 6-in. pumps will get the most oil, because a greater volume of steam flows there, and the oil will go with the current. The 8-in. pump will get more than the 6-in., as oil always goes to the top of steam or water.

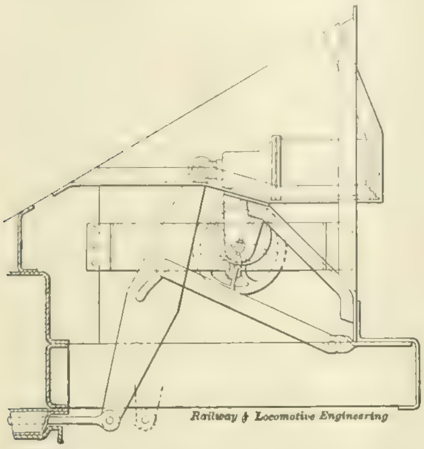
HERBERT RIDDLE.

Alamogordo, New Mexico.

Adjustable Device for Loaded and Empty Cars.

I send you herewith a drawing of an adjustable braking device adapted to loaded and empty cars, as the case may be, patents for which have just been issued to me. It will be noted that I have slotted the cylinder lever so as to be able to raise and lower the fulcrum point. The angularity of the slot avoids an increased piston travel when the fulcrum is lowered. The changing of the fulcrum point is done by means of cast iron eccentric with a wrought iron strap which is connected to the fulcrum lever. The rod passes through the cast iron eccentric with a spring on one end so as to

hold it in its proper position. In order to turn the eccentric, it is necessary first to compress the spring about ½ in. This allows the key in the rod to come out past the key slot in the bracket holding the eccentric. After making half a revolution, the spring forces the rod back and comes into the slot for the lower position.



ADJUSTABLE DEVICE FOR LOADED AND EMPTY CARS, SHOWING LEVER SLOT CONNECTION IN "LIGHT CAR" POSITION.

It will also be noted that the rod is extended from one side of the car to the other, so that it can be operated from either side.

Some tests were made a short time ago with this device. The first test was taking an 80,000 capacity car, loaded to its marked capacity, setting the fulcrum in the empty car position. After getting the car traveling at the rate of 12 miles per hour, with train line charged to 70 pounds, the car was detached from the engine and the brake applied. The car ran 280 feet before making a stop.

The same test was repeated with the fulcrum pin dropped to the lower end of the slot, and the result was that the car ran but 140 feet, or one-half the distance of the first test. This was repeated with different speeds up to 30 miles per hour. The proportional difference between the two positions remained practically the same.

There are fifty cars equipped with this device running on the Delaware, Lackawanna & Western R. R., and I am told that the train and engine men speak very highly of it. Of course this device must be operated by hand, and makes another part of the brake to look after. At the same time I think everybody realizes that it is impossible to apply a device of this kind to work automatically, as the only opportunity to make it automatic in its operation is to use the compression of the springs, and they vary so that an operation so dependent would not be at all reliable or accurate.

There are records of changing the fulcrum position on cars of the Delaware, Lackawanna & Western R. R. at the rate of four cars per minute. It will therefore be seen that it does not take a great while to make the change.

L. T. Canfield.

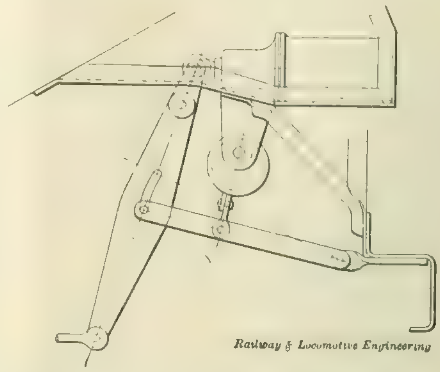
New York City.

Retarding Power of Driver Brakes—Shocks on Long Trains.

Having come to the conclusion that shocks on long trains, due to releasing the brakes at low speed, are caused by the slack being suddenly stopped from running out, and that high main reservoir pressure, or large volume, will not entirely eliminate this condition of things, as was shown in my article relating to this matter in the February number. It appears that the only way to prevent these shocks is to either not to release at low speed or provide some means to prevent the slack from running out when releasing, until the rear brakes have released.

I came to the conclusion that it is not practical, under all conditions of service, to run trains without releasing at low speed, and that the only practical way of overcoming this trouble was to provide retaining power on the driver brake. With this idea in view I tried, some ten years ago, a valve which was fastened to the under side of the running board, the stem of which was extended so that the end was just above the top of the board in front of the engineer's seat. A pipe connection was made from this valve to the exhaust port of the driver brake triple valve. It was necessary, as can be plainly seen from the above explanation, for the pressure in the brake cylinder to pass through this valve in order to escape and release the brake, providing all the connections and the packing leather in the brake cylinders were tight. In operating, the engineer closed this valve by placing his foot on the stem, just before releasing, and when sufficient time had elapsed for the rear brakes to release, would permit the driver brake to release by moving his foot off the stem of the valve.

This valve demonstrated that the principal was right; that is, if the head end of a train is held back until the rear brakes have released, severe shocks, due

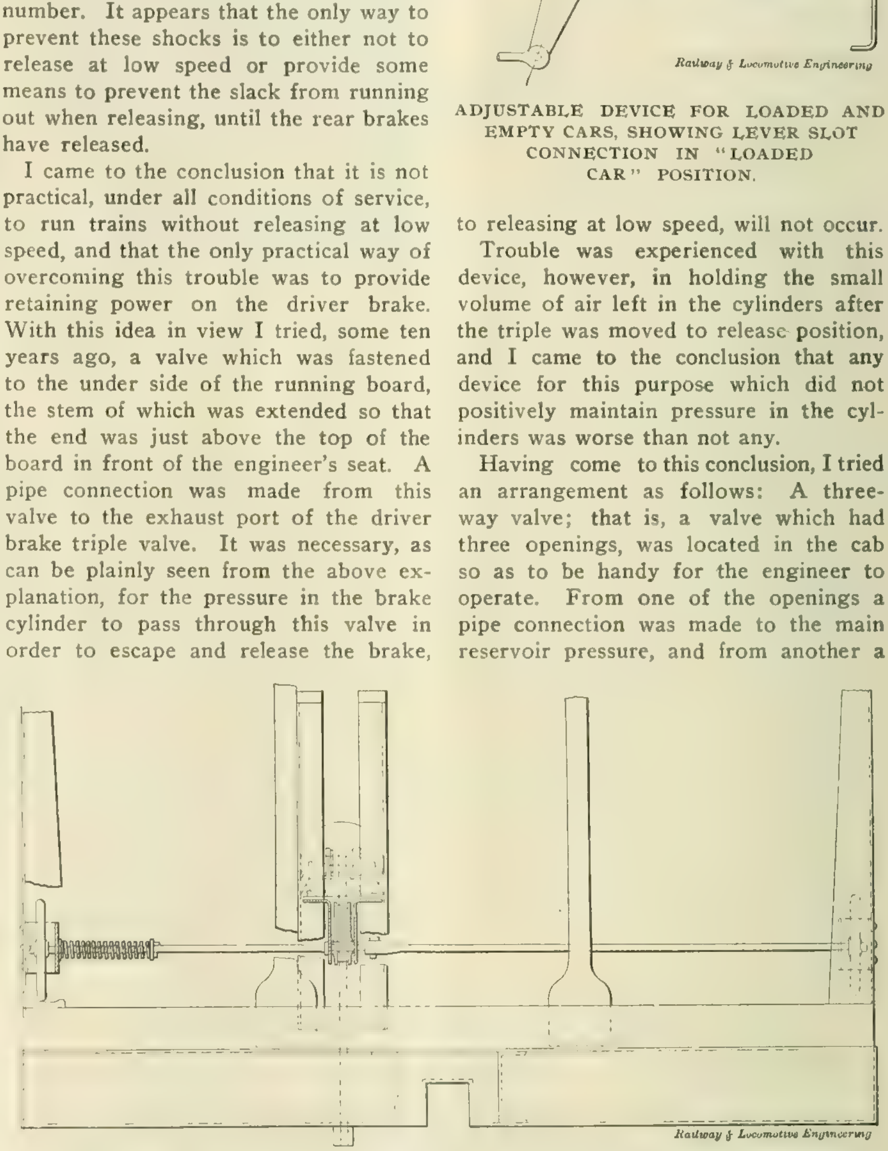


ADJUSTABLE DEVICE FOR LOADED AND EMPTY CARS, SHOWING LEVER SLOT CONNECTION IN "LOADED CAR" POSITION.

to releasing at low speed, will not occur.

Trouble was experienced with this device, however, in holding the small volume of air left in the cylinders after the triple was moved to release position, and I came to the conclusion that any device for this purpose which did not positively maintain pressure in the cylinders was worse than not any.

Having come to this conclusion, I tried an arrangement as follows: A three-way valve; that is, a valve which had three openings, was located in the cab so as to be handy for the engineer to operate. From one of the openings a pipe connection was made to the main reservoir pressure, and from another a pipe connection was made to the exhaust port of the driver brake triple valve, and the third opening was left open to the atmosphere. With the valve in normal position communication is closed from the main reservoir, and open from the exhaust port of the triple to the atmosphere. In this position there is no interference with the release. Pressure



ADJUSTABLE DEVICE FOR VARYING THE BRAKING POWER ON LOADED AND EMPTY CARS, SHOWING ARRANGEMENT FOR SHIFTING THE FULCRUM IN SLOT OF CYLINDER LEVER.

in the brake cylinders could be noted by a gauge which was connected directly to one of the cylinders.

Directly below the retaining valve, connected to the pipe connecting it to the exhaust port of the triple, was a safety valve adjusted for 50 pounds pressure. When it was desired to hold the driver brake applied and release the train brakes, the handle of the retaining valve was moved so as to cause the opening to the atmosphere to be closed, and establish communication between the main reservoir and the exhaust port of the triple, and when the triple was moved to release position, main reservoir pressure would be admitted to the brake cylinders. The flow of air to the cylinders could be regulated by the port openings in the retaining valve so that very little air was wasted at the safety valve.

(*Continued in next number.*)

Handling the New York Engineers' Brake Valve.

(*Concluded.*)

Before closing this article, it will be useful to remind the reader that it is a good plan, when it is known beforehand, that the engine is to be coupled on to a train that is to be charged up, to make one or two applications of the brake on the light engine, just before coupling, and return the handle to positive lap position after each application. Holding down the auxiliary reservoir pressure in this way, and having the handle on lap, prevents the danger of losing the main reservoir pressure through carelessness on the part of the trainmen in closing a rear angle cock before turning on the air from the engine, and will permit of quickly releasing the brakes on the engine and tender after the hose between the tender and train have been coupled, and the angle cocks opened.

In making water-tank stops and other accurate stops with passenger trains of ordinary length, avoid overcharging the train pipe, when releasing the brakes, after the first application, and to holding the handle in release position too long; but instead move the handle promptly, after the release has been effected, to lap position.

This method of operating the brake valve will enable the train pipe and auxiliary reservoir pressures to equalize quickly, and when the second application is commenced to stop the train on the mark, your brakes will respond promptly.

T. L. Burns.

New York.

QUESTIONS AND ANSWERS

ON AIR BRAKE SUBJECTS.

(50) C. W. C., Arcata, Cal., says:

What defects will cause a blow, either on the up or down stroke? A.—Any of the valve motion parts of the pump leaking live steam into the exhaust, will cause the pump to blow. If the packing rings of main piston should leak the pump will blow on the down stroke and also on the up stroke.

(51) H. L. J., Xenia, O., asks:

What is the meaning of shoe-bound? A.—This term refers to the brake shoes dragging on the wheels, due to the slack being taken up too close. Sometimes brake shoes are driven on to the beams without letting out the slack, and when the car is started the shoes drag and rub on the wheels; hence the term "shoe-bound." Sometimes the slack is taken up too tightly, producing the same trouble.

(52) C. W. C., Arcata, Cal., asks:

If air pump runs hot on the road how would you proceed to cool it? A.—Put some heavy-bodied valve oil on the swab of the piston rod, feed a reasonable quantity into the air cylinder through the oil cup, and slow down the speed of the pump, carrying a lower pressure if necessary. Of course, slowing down the pump will reduce the output of air pressure, but this is preferable to burning up the pump and being obliged to shut it down altogether.

(53) B. R. J., Albany, N. Y., writes:

Will an air pump, without a governor, pump pressure in main reservoir equal to that in boiler? A.—Yes, and even higher, if the air cylinder is sufficiently smaller than the steam cylinder. The 8-inch pump, which has 8-in. steam and 7½-in. air cylinders, will do it, but the 9½-in. pump, whose steam and air cylinders are equal in diameter, will not do it. Some modified forms of the locomotive pump, where air cylinder is much less in diameter than the steam, are now being made for other uses, and deliver a much higher pressure of air than the steam required to run the pump.

(54) W. N. P., Newark, O., writes:

We have received a new Pennsylvania engine here, built by the Baldwin Works, which has a peculiar auxiliary valve or cock under the brake valve. There is a small copper pipe connected with this cock and the whole arrangement is in the main reservoir pipe and is about 6 inches under the brake valve. Would you please say what this is for. A.—This is doubtless the standard double-heading cut-out cock of the Pennsylvania type. This cock is placed in the main reservoir pipe and is so designed that when the engine is second in a double-head train, and the cock closed, the engineer can note the train line pressure as it rises and falls on his gauge, due to the operation of the brakes by the head engineer. He can also apply brakes in service position as well as in emergency if he desires, without being obliged in any way to operate the cut-out cock. This is doubtless the device to which you refer.

(55) T. H. B., Toronto, Ont., writes:

With the D-8 brake valve was the pressure held in chamber D and equalizing reservoir when the brake valve handle was thrown to emergency position? I am told this, but with the F-6 valve, the black hand pressure reduces slowly, finally coming down to zero. Please answer and settle the argument. A.—The D-8 valve was so constructed that it held the air imprisoned in chamber D and equalizing reservoir when an emergency application of the brake was made. In this event the black hand of the gauge showed no reduction, except that caused by leakage of chamber D pressure past the equalizing piston ring into the empty train pipe. With the present form of valve, however, the equalizing reservoir pressure escapes by groove P in the under side of the rotary and groove H in rotary seat, which are made longer in the F-6 valve than they were in the D-8 valve. This permits the pressure to escape and the black gauge hand to fall.

(56) J. T. T., Philadelphia, Pa., writes:

We have the latest improved engineers' brake valve with slide-valve feed valve attachment on our engine, which ought to be new, as the engine came from Baldwin's Locomotive Works in March. Now, when you make a service application the brake will stay set, but when you go to emergency, the brake whistles off through the triple valve. If you close cut-out cock in train pipe under brake valve right away, the brake will stay set, but when you open cut-out cock the brake whistles off. A.—We assume that in making the emergency application you have returned your brake-valve handle to lap position, after drawing a certain amount of pressure quickly from the train pipe. In this case the train-pipe pressure has been reduced, but the pressure in the equalizing reservoir remains undisturbed. When the brake-valve handle is returned to lap, the pressure in the equalizing reservoir passes by the equalizing piston packing ring into the train pipe, raising the train-line pressure and forcing the triple valve to release position. However, if you leave the brake-valve handle in emergency position after making the service application, you will find that the brake will stay on, as it is impossible in this case to raise the train-line pressure above that remaining in the auxiliary reservoir, therefore the triple valve cannot move to release position and cause the brake to whistle off.

It is reported that the South Side elevated railroads, in Chicago, are discarding the Christensen engineer's brake valve and are substituting the Westinghouse brake valve for it on all their cars.

Write us for air-brake books. We have all the best ones.

New Canadian Pacific Parlor Cars.

The Canadian Pacific Railway have recently added two parlor cars to their passenger rolling stock. The exterior finish and decorations conform to Canadian Pacific standards and these cars have all the up-to-date improvements in car construction which are to be found anywhere. Especial attention has been given to strength, and advantage has been taken to reinforce parts where experience has shown the need. The length of the car is 72 ft. over body sills, the extreme length over buffer plates being 79 ft. 10¾ in. The exterior finish is Mexican mahogany, tastefully decorated in gold. In designing these cars, the C. P. R. authorities aimed at smooth surfaces, light profiles and they have eliminated all carving. A very fine appearance has been obtained by the use of rich mahogany veneers and neat marquetrie borders and lines decorated in light shades of green.

The chairs are upholstered in pale green plush and have been designed with a view to comfort. The smoking room is supplied with eight chairs of same design as in the main room, but these latter are upholstered in maroon-colored leather. The walls of the smoking room are divided off, by means of marquetrie lines, into large panels which extend from within a few inches of the floor up to the base line of the monitor deck. The veneer used in this room is African mahogany. Each car has two ladies' toilets, a men's toilet and a men's saloon, all being fitted with the latest improved flushing closets and nickeline washstand tops.

The main room or parlor has four double Acme lamps. On each side of the parlor are eight large plate-glass windows, the glass being 26x48 in. Each window is fitted up with double top and bottom sashes, the inside bottom being set in a brass-hinged frame; this is to enable attendants to easily clean the glass. Between each window space is a richly veneered and inlaid pilaster, extending from the top of the truss plank to the base of the side cove, while along the base of the side cove runs a neatly inlaid moulding.

The bulkheads or end partitions are in keeping with the side elevation, being veneered with the same quality mahogany, and divided off by pilasters, which extend from the floor to same elevation as side pilasters. These bulkheads are recessed in elliptic lines, which gives the end views a very novel appearance, advantage being taken with this to form an overhead cove of art glass in colors which match the deck lights. The ceilings are of the Empire style and neatly attached to the lower end of each center lamp is an ornamented brass bell-cord eye, through which passes the signal cord. This does away with the objectionable swinging bell-cord hanger. These cars represent all that is new and up-to-date in the way of beauty and luxury. The chairs, which stand squarely on four legs, can be moved as desired, and in their comfort and elegance invite an unlimited trip, while the eye is never tired taking in the quiet richness of the interior decorations.

The entire absence of grill work, carved bosses or mouldings, removes that dust-harboring form of car decoration which is the bane of cleaners. There are no hangings or portieres to collect disease germs, and altogether the scheme of color and form is like "beauty unadorned is adorned the most."

The weight of the car is stencilled inside the men's lavatory. This practice is being followed with passenger equipment by the Canadian Pacific so that the conductor in making up the journal or record of his train can get the weights in each case. This permits the passenger service to be worked out on the ton-mile basis, the same as freight trains are.

CANADIAN PACIFIC PARLOR CAR "RICHELIEU."

Old-Time Railroad Reminiscences.

BY S. J. KIDDER.

I suppose every division of a railroad has its meanest man, at least some individual by his words or actions usually acquires that reputation among his fellows, and in the instance I am about to relate Symson Lovell enjoyed this distinguishing mark of opprobrium.

Sym. was among the oldest engineers on the road, both in years and term of service, and for reasons, by no means unknown among the rank and file, enjoyed opportunities by which he could often shift unpleasant duties to other shoulders, thus permitting himself to recreate in slothful indulgence, while some one less fortunate did his work, he, meantime, drawing full pay.

His fireman, John Nickson, too, either by nature or association, had developed many of the traits so prominent in Sym., frequently laying off at the same time. The men were careless in their dress, general appearance and work, and quite naturally numerous ear marks about their engine indicated that wind and rain were the elements depended on to remove dust and dirt rather than elbow grease on the part of John. Even the scattered coal on the cab deck was permitted to repose there until it interfered with the swing of the fire-box door before he used his shovel to sweep it out. Taking Sym., his fireman and their engine, the "J. W. Grimes, No. 19," as a whole, they formed a combination difficult of duplication.

It was Sym.'s practice to neglect every-

thing so long as he could worry along, but when the inevitable occurred, such as setting up the wedges or other work essential to maintain an engine in proper working condition, then was his time to lay off a trip, a privilege always accorded to suit Sym.'s pleasure.

It usually fell to my lot to run the "Grimes" at such times, to which I did not seriously object, as pulling varnished cars was, with me, like other young engineers, an inducement, and I took no little pleasure in working all day at the other end of the division fixing up the engine, but after a time the novelty wore away and I realized Sym.'s object and the fact that he was getting decidedly the better of the bargain, and the conclusion arrived at was that a good freight engine was preferable to a poor passenger one.

Sam. Seavers, with the "Gen. Sherman," had the run opposite Sym., and one night it fell to my lot to go out on Seavers' engine. I made the west-bound trip, and on my return the following evening, just before starting out, received a telegram that Seavers was coming with the "Grimes" and for me to change off with him when we met, the meeting point being at Albia, 90 miles away. Upon receiving the message I realized that trouble was in store for me, but comprehended but slightly what a strenuous night I was destined to put in before again reaching Creston. Pulling out we reached Albia on time (midnight), but No. 1 was not there, neither could a headlight be seen down the two miles of straight track extending slightly beyond Central Crossing. That No. 1 was somewhere in the vicinity was evident from the order received on our arrival holding No. 2 for No. 1, the operator also imparting the information that the latter train had left Frederic, nine miles away, on time, and its nonappearance was somewhat confusing to us.

Quite a coterie had gathered on the station platform and speculation was rife as to the cause of delay until finally a headlight was seen rounding the curve at the end of the tangent, but the deliberate speed with which it moved presaged that something had gone wrong with the train. Slowly the light approached, first disappearing into one dip, then the other, the track following the raises and depressions of the rolling prairie between the crossing and Albia, from the latter of which it failed to emerge, but in its stead a lantern hove in sight over the hog-back, and as it approached the platform we saw Seavers with it afoot and alone.

He had stopped for water at Frederic and shortly after climbing the heavy grade west of the town the left hand tank hose had become detached from the feed pipe and this had only been discovered when the other pump failed to work from lack of water supply, the train meantime being some three miles from Albia.

Sam. stopped, cut loose and endeavored to reach this station with the engine, but for lack of fluid in the boiler had been obliged to extinguish his fire. Under these conditions, however, he had had no scruples in turning the defunct "Grimes" over to me, which, in my stupid innocence, I permitted him to do, being oblivious at the moment that there are times when a refusal to obey orders is justifiable.

that station, where, after procuring the supply required, she was propelled up and down the main line until her boiler had been replenished, after which she was shoved in on her train, the freight then departing without offering further assistance. The next requisite was wood with which to fire up, and which was procured by a vigilant search through the timber and scattered buildings in the vicinity until a sufficient quantity of dead limbs, fence rails and boards from an abandoned lean-to had been gathered to fill the fire-box, several of the passengers lending a hand in their anxiety

INTERIOR OF PARLOR CAR "RICHELIEU"—C. P. R.

The engine of a freight train standing at the station was procured, to the front end of which was attached a flat car, and we sallied forth for the "Grimes," finding the engine where Sam. had deserted her, coupled into and hauled up to the station, following which Seavers pulled out with No. 2.

Finding, of course, his former train where he had left it he pushed it back to Frederic, set it on the side track, then resumed his homeward journey.

The first thing required by the "Grimes" was to get her to Frederic and get a tank of water, which was accomplished by towing her in a freight train to

to facilitate a resumption of their journey.

The "Grimes" was finally resuscitated, and four hours behind the schedule time, No. 1 was again moving westward.

Albia was soon reached and finding the coal pile seriously depleted a fresh supply was taken by pitching on a sufficient quantity of chunks to insure making Chariton, the regular coaling station. At this point the tender was loaded to its capacity and things seemed to be coming our way when all at once, while descending White Breast grade, upon striking a curve, the headlight gave several spasmodic flickers, the blaze then

vanishing into innocuous desuetude, and as this indicated an abbreviated wick, a lantern was suspended from the bracket in due respect to time card rules.

The "Grimes" was handling a train that well taxed her capacity on the ascending grades, and as we approached Thayer I began feeling apprehensive, both on account of the rapid disappearance of the coal pile, which made it questionable as to our supply being sufficient to take us to Creston, the other whether we could get the train through the sharp curves of Thayer hill, it being about daybreak and an extremely slippery rail, should we stop there for fuel.

At this moment a happy thought came to mind, for when passing Afton, situated on the summit of a divide ten miles from Creston, the evening before, I had casually noticed two flat cars loaded with wood standing on the house track, and it occurred to me that as a last resort we could appropriate a sufficient supply for our needs, and acting on the impulse I let the "Grimes" take a flying run through Thayer which easily disposed of the grade I had been dreading. The pull up Afton hill was a long, hard one, it being the heaviest westbound grade on the division, but with the lever in the corner and the throttle wide open the "Grimes" reached the station.

Stopping at the water tank the next move was to get our prospective supply of wood which my optical research failed to locate, and my consternation may be imagined when it was learned that the cars with the much needed fuel had been picked up by a passing train during the night. The last prop being gone nothing was left but for us to husband our resources so far as conditions would permit, and if it was found impossible to make Creston, cut loose and run for coal, though this I did not propose to do if by hook or crook it could be prevented.

Well, I started the train from the station, shutting off as we left the yard, and pitched down the grade ahead, permitting gravity to propel us some two miles. A light throttle then took us to the foot of Creston hill, where the final chapter began. The hill was some four miles in length, moderate in steepness as compared with the ruling grades, and in climbing it fuel economy rather than speed was the desideratum eagerly sought.

As we ascended the hill I mounted the tank and began mining operations by loosening up the heavy crust of mixed coal and cinders, sorting out the links and pins, and shortly before the top of the grade was reached the last scrapings of coal, slack and cinders had passed the fire-box door.

Passing the summit a medium descending grade a mile or so in length was before us, then a sharp up-grade less than half as long into Creston yard. To get over that pitch but one thing was left to be done. The fire would soon be gone, and why not sacrifice the water? So just as we struck the down grade I shut off the pump, assuming that the crown sheet would be in no danger.

We made the goal, but when the "Grimes" stopped at the station an abundance of red clinkers lined the grates, water could not be found in the lower gauge cock and the steam gauge registered 45 pounds.

It is needless to remark that little work was done that day in rehabilitating, though the engine had a broken water glass, the headlight wick required renewal, the pump plungers and pistons were shy of hemp packing, in short there were few things about the engine that did not require attention. The piston on my side and one pump was packed sufficiently for the return trip; the headlight reflector placed on the rear of the tender facing ahead that the falling dew and sparks from the diamond stack might possibly bring out some of its original luster, it being replaced for the trip by one borrowed from the "Blackhawk," an engine on a daylight run.

The next morning I was at the Ottumwa round house early to return the reflectors to their respective places and remove the packing temporarily placed in the stuffing boxes the day before, and had but just got through when Sym. Lovell walked in.

He climbed into the cab noticing the undisturbed broken water glass. Next he took a walk round the engine noting the position of the piston and pump glands all hard against the stuffing boxes, but when he surveyed that headlight reflector, the color of which may be imagined after a night's ride on the tender, he tumbled. Walking over to a bench where I was sitting he wanted to know why I did not put in a water glass, to which I replied that a Yankee didn't need it. Then he inquired about the headlight wick and numerous other things, to which I replied evasively and concluded by asking if I had reported certain shop work, my reply being in the negative. Straightening up he demanded to know why I had not reported this work. Well, Sym., said I, the old 19 is a horrible example of what a negligent, incompetent and lazy man can accomplish, and I'm through fixing her up for you, and as for reporting shop work, the only thing compatable with truth would be general debility requiring a jacking up of the whistle and putting a new engine under it, but knowing she couldn't be spared from her run to-night and that you are going out I thought it best to mark nothing on the slate.

OIL BURNING FREIGHT ENGINE—TRANSCAUCASIAN RAILWAY.

A Curious Cause for a Strike.

A curious cause nearly led to a strike in the Baldwin Locomotive Works last month. The men have been accustomed to wear canvas bag aprons to prevent their clothing from being saturated with the oil and grease which they use while working. A few days ago a fire broke out and its origin was attributed to spontaneous combustion due to the careless way in which the workers allowed the oil-soaked garments to lie around. The fire nearly developed a conflagration and as a result an order was issued prohibiting the dangerous apron from being worn as a part of the workers' garment.

The men protested and the superintendent provided them with bags, but they allege they are of an inferior material and not the kind they should have to be free from refuse oil and grease.

A new locomotive manufacturing concern is to be established at Toronto, Ont., under the name of the British American Locomotive Works. A charter has been obtained from the Ontario government, with a capital stock of $1,000,000.

Ten-Wheel Engines for the Central of Georgia.

A short time ago the Central of Georgia received some simple 4-6-0 engines from the Rogers Locomotive Works, of Paterson, N. J. These engines have cylinders 19x20 in., and the driving wheels are 69 ins. With a pressure of 200 lbs. to the square inch, the calculated tractive force of these engines is about 23,100 lbs., and as the weight on drivers is 116,000 lbs., it follows that the ratio of adhesive weight to tractive power is about 5. The total weight of the machine is 148,000 lbs. The symmetrical appearance which these engines have is no doubt in part due to the fact that the drivers are all equally spaced and the center line of the boiler is so placed as to add to the general effect. The drivers are equalized together on underhung springs.

The valve motion is indirect connected and the valves are of the ordinary balanced slide-valve type. The cross-heads are the two guide-bar style, with the upper part of the top guide slightly overhanging the cross-head, which is lipped up into the recess, thus avoiding collecting dirt and grit.

The boiler is 62½ in. in diameter at the smoke-box end, and is of the extension wagon-top type. There are about 2,123 sq. ft. of heating surface in the boiler and the length of the tubes is 13 ft. 7 in. The whistle is placed in a somewhat protected position behind the dome, and the pop valves are below the level of the dome casing, which adds to the general appearance of the machine. The headlight, as will be seen in the illustration, is electric, and the beam of light is thrown from an 18-inch reflector.

The tender frame is made of 10-inch steel channels; the trucks are of pressed steel and the wheels are cast iron centers, steel tired, with retaining rings. The water capacity of the tank is 5,000 gallons.

A few of the leading dimensions are appended for reference:

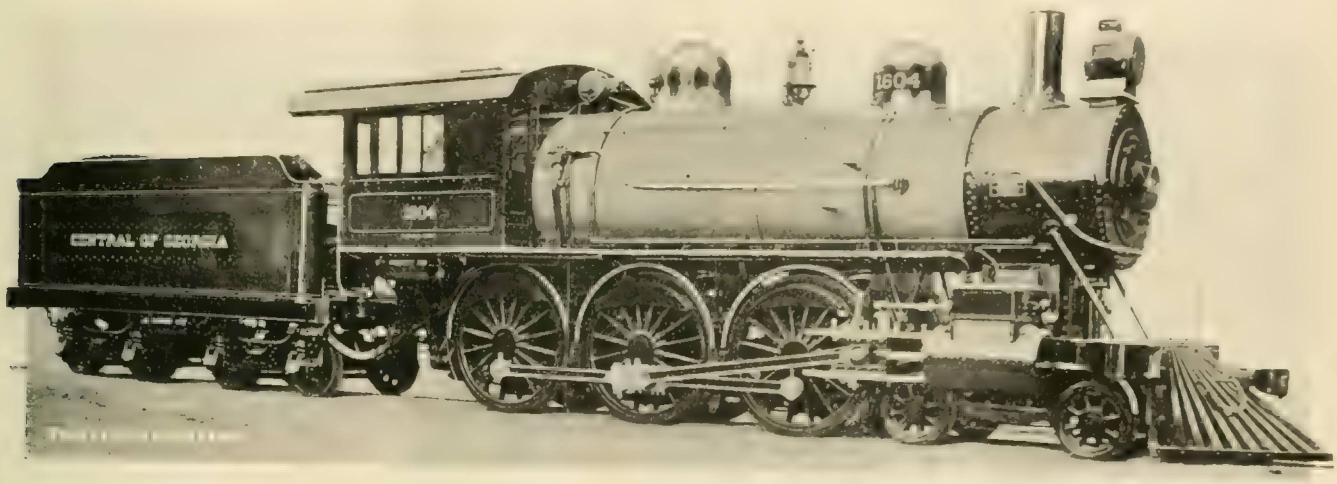
Cylinders, 19x26 in.

Drivers, diameter, 69 in.; driving journals 9x12 in.; driving wheel base, 13 ft.; total wheel base of engine, 25 ft. 5 in.; weight on drivers 116,000 lbs.; weight on truck, 32,000 lbs.; total, 148,000 lbs.

Heating surface, tubes, 1,955.80 sq. ft.; firebox, 167.57 sq. ft., total, 2,123.37 sq. ft.; grate area 30.59 sq. ft.

Tubes, diameter, 2 in. O.D.; length, 13 ft. 7 in.; thickness, No. 12 gauge; total number, 275.

Boiler, working pressure, 200 lbs.; thickness of barrel, $\frac{11}{16}$ in.; thickness of dome course, ¾ in.; thickness of crown, $\frac{7}{16}$ in.; thickness of tube, $\frac{9}{16}$ in.; thickness of side, ⅜ in.



ROGERS TEN-WHEEL ENGINE FOR THE CENTRAL OF GEORGIA.

Shooting Round the Corner.

We once saw a man suffering from delirium tremens who imagined that an enemy was after him with a gun which the sufferer believed had the peculiarity of shooting round a corner. We supposed that an attack of jim-jams was necessary to make people believe anything could be made to shoot round the corner, but the claim for an equivalent performance comes to us in a dispatch from Pueblo, Cal. The dispatch says: "Sherman Hobson, a well-known railroad man of this city, has just perfected an appliance which, if all proves true that is claimed for it by its inventor, will greatly reduce railroad collisions and save thousands of lives annually. The new appliance is a sort of looking glass to be hung on each side of an engine to enable the engineer and fireman to see the roadbed for six miles, both in front and in the rear. The chief value of the invention is that it does not make any difference if the road is curved or straight. The instrument works on the principle of a mirage, and it has been named by its inventor as the "miragescope."

A Miniature Locomotive.

A working jeweler in Meridian, N. Y., has devoted three years of his leisure time to making a toy locomotive. Working a hobby of this kind is much more profitable than many others that men ride to occupy leisure hours, and it develops knowledge as well as skill. Think of setting the valves of a locomotive that are only ¼-inch wide and adjusting the eccentrics to suit!

The locomotive is heavily plated with gold, and the bell, whistle and driving wheels are solid gold. The trimmings are of silver. The locomotive is six and a half inches long and the tender is three inches long. The boiler is three-fourths of an inch in diameter, the smokestack two and one-sixteenth inches high, and the rest of the parts are in proportion. Kerosene is used for fuel and steam is raised in less than two minutes. The whistle blows, the bell rings and every part of the locomotive works perfectly.

May not the complaint that common people are above their station often take its rise in the fact of *un*common people being below theirs?—*Nicholas Nickleby.*

Railway Signaling Club Meeting.

The May meeting of the Railway Signaling Club discussed Mr. Sperry's question, which was: "In the preparation of time-tables what consideration is given to the block-signal capacity of the line?"

The Pittsburgh & Lake Erie road's experience did not bear directly on the question, as many of their freight trains were run as "extras" and not set down in the time table. The block signal system has, however, been of inestimable value. The speed of freights had been increased. Trains running in sections were able to follow one another closely with safety under high speed. Rear-end collisions had been reduced to a very satisfactory minimum.

On the Lehigh, freight trains were not on the time table. A great saving in the

running of slow freights had been effected by running them ahead of fast freights where required until ordered by the dispatcher to take a side track.

On the C., M. & St. P., the block signal capacity of the road was not considered in making a time table. Trains cannot be run any closer than the distance apart of the block signals.

The capacity of the Santa Fe had been increased considerably by the staff system chiefly on account of doing away with train orders and the consequent loss of time involved in their use. On the mountain with four engines 25 or 30 orders were often given and it generally took the crews 40 minutes to read them and get ready. There was no necessity for a time table under the staff system.

The question was then re-stated on motion and put in the form "Does the block system increase the capacity of the line?" One speaker pointed out that here single track blocking must be distinguished from double track blocking. On single track, if the length of blocks is 4 or 5 miles, it is not possible to run as many trains as without the block. Some trainmasters have held that 55 trains a day very closely approaches the capacity of the track. On double track roads, it is largely a question of how much the company will spend on signal equipment. Short blocks mean many signals and increased track capacity.

The discussion then turned somewhat to the matter of giving train orders by telephone, but returning to the question of capacity another speaker said there was no question on his line about the increased capacity of the road. He said, "We had a heavy freight movement last year and our freight trains have been run down that hill under automatic signals, permissive of course, and we have had no accidents; whereas, we had accidents before, on that same grade."

South African Visitor's Views on British and American Engines.

We recently had a visit from Mr. Philip A. Hyde, chief locomotive superintendent of the Central South African railways, whose home is in Pretoria. Mr. Hyde paid the United States a flying visit for the purpose of buying some engines for the railways of the Transvaal and Orange River Colonies. He visited New York, Philadelphia, Altoona, Pittsburgh, Buffalo, Dunkirk, Schenectady and other cities in which large railway and electrical interests are centered. During the brief time at his disposal Mr. Hyde, who has had an extensive and varied experience on the government railways of India, has closely observed American methods and practice, riding upon engines and making personal studies of our ways of doing things.

He spoke of the great difficulties experienced in the work of organization in the various railway departments after the war. The locomotive department, requiring as it does, skilled and intelligent workers, was at first seriously handicapped by the unpromising material which stepped from the ranks and laid down the rifle, the bandolier and the bayonet for the hammer, the throttle and the scoop. The federation of the former Netherlands Railway with that of the Orange River, has been effected, even before the political federation of the various states has been brought about. The earnings of both roads are pooled and the government of each colony is paid on a prearranged basis. The general officers, however, have jurisdiction over both roads and are entirely removed from political influence of any kind. They are directly responsible to Lord Milner, the High Commissioner.

Speaking of British and American engines in South Africa, Mr. Hyle had kind words to say for the American machine. They were well liked, and every effort had been made to give them a perfectly fair trial. In assigning engines, the existing premium sheet had been taken and the best men selected. The first was given an American engine, the next on the sheet was given a British engine, the next an American, and so on. After they had run for some time and each man had become familiar with his engine, the performance was closely watched and coal weighed on and off, and repairs recorded. The engines were expected to do a certain definite work. They had to haul so many tons, so many miles, on a given schedule. The work was ton-miles per hour, if one may so say. In this test it was found that the British engines were 14 per cent. cheaper on coal for a given ton mileage, while the American locomotives were 20 per cent. more economical in the matter of repairs.

One of the reasons why the American engines were lighter on repairs was that they had better tires than the English engines. They had much better springs and their balanced slide valves far outlasted the plane slide valves of their rivals.

This very satisfactory maintenance figure was unfortunately reduced by some very bad tank work. All the tanks had to be raised off the tender frames and seams had to be re-rivetted. That, together with repeated failures of some studs in the boilers, used for securing back head stays, reduced the amount otherwise gained by 7 per cent.

In the matter of coal economy, Mr. Hyde regarded it as a purely engineering question in which American builders can secure results quite as satisfactory as those of British builders, if they would design their engines to suit existing conditions.

Just here we may be permitted to remark that therein lies the whole secret of successful competition in foreign fields. If foreign buyers want engines that save coal with known loads; if they do not care for the reserve power necessary to lift two or three cars out of an awkward siding and add them to an already nominally full train, then it is "up to" American manufacturers to build coal savers.

In the matter of inferior work, there is absolutely no excuse for shipping American products abroad which have been worked up in the cheap and nasty style. Those manufacturers who do it, especially with railway material, not only seriously damage their own reputations and curtail their chances of future business, but they wantonly handicap every other American concern which legitimately attempts to enter and compete in the foreign markets of the world.

"Far from the Madding Crowd."

While waiting for the train the June bride and bridegroom walked slowly up and down the platform.

"I don't know what this joking and guying may have been to you," he remarked, "but it's death to me. I never experienced such an ordeal."

"It's perfectly dreadful," she answered. "I shall be so glad when we get away from everybody we know."

"They're actually impertinent," he went on. "Why the very natives——"

At this unpropitious moment the wheezy old station master walked up to them.

"Be you goin' to take this train?" he asked.

"It's none of your business," retorted the bridegroom, indignantly, as he guided the bride up the platform, where they condoled with each other over the impertinence of the natives.

Onward came the train, its vapor curling from afar. It was the last to their destination that day; an express—nearer it came at full speed, then in a moment it whizzed past and was gone.

"Why in thunder didn't that train stop?" yelled the bridegroom.

"'Cos yez sed 'twarn't none of my bizness. I has to signal if that train's to stop."

And as the old stationmaster softly stroked his beard there was a wicked twinkle in his eye.—New York *Commercial Advertiser.*

Not long ago the estate of the late William C. Baker won a suit in the Circuit Court for the Northern District of Illinois, which had been brought by the heirs to prevent infringement of rights held under the Baker patents upon car heating apparatus and fittings. The case was, however, carried to the United States Circuit Court of the Seventh District, and a decision has just been rendered affirming the decision of the lower court.

Of Personal Interest.

Mr. S. Morgan has been appointed foreman of the Wheeling & Lake Erie blacksmith shop at Norwalk, Ohio.

Mr. J. M. Gailey has been appointed foreman at Brownwood, Texas, on the Frisco system, vice Mr. E. J. Timlin, resigned.

Mr. J. B. Ward has been appointed road foreman of engines on the Cleveland, Akron & Columbus, with headquarters at Akron.

Mr. J. H. Pollard, master mechanic on the Illinois Central Railroad, at Centralia, Ill., has tendered his resignation to the company.

Mr. J. E. Loy has been appointed master mechanic on the Chicago, Rock Island & Pacific at Valley Junction, Ia., vice Mr. D. W. Cunningham, resigned.

Mr. William B. Ott has been appointed assistant master mechanic of the Pennsylvania Railroad, with office at Harrisburg, Pa., vice Mr. Lyman, resigned.

Mr. James Lauder has been appointed master mechanic on the Fort Worth & Rio Grande Railway, at Fort Worth, Tex., vice Mr. Chas. Buck, resigned.

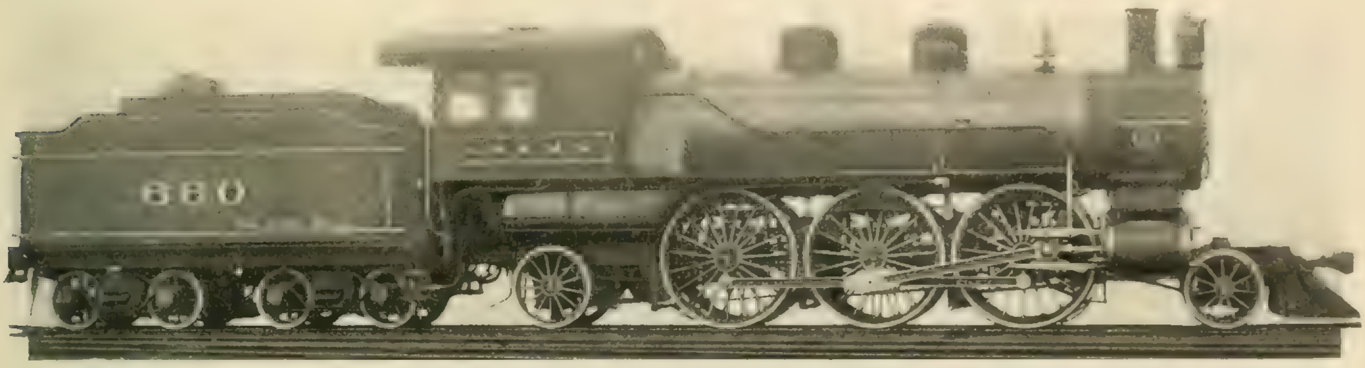
Mr. A. W. Martin has been appointed assistant general superintendent of the New York, New Haven & Hartford, with

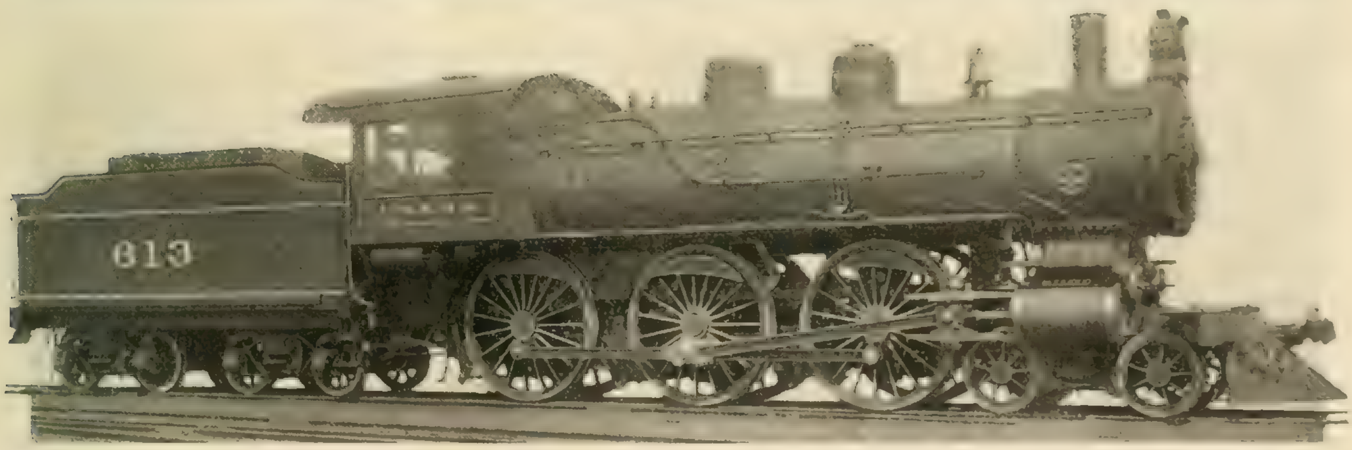
Central & Hudson Bay Railway, to engage in private business in Toronto, Ont.

Mr. W. A. George has been appointed round-house foreman on the Chicago & Alton, at Bloomington, Ill. He was formerly with the Colorado & Southern.

Mr. E. J. Timlin, formerly foreman on the Brownwood shops of the Frisco system, has been appointed master mechanic on the Rock Island, at Chickasha, I. T.

Mr. W. F. Teat has been appointed master mechanic of the Atlanta, Knoxville & Northern, with office at Blue Ridge, Ga., vice Mr. S. J. Anderson, deceased.





ENGINES THAT PULLED TRAINS ON EXTRAORDINARY FAST RUN OVER LAKE SHORE & MICHIGAN SOUTHERN DESCRIBED ON PAGES 281, JUNE NUMBER.

Mr. C. E. Fuller has been appointed assistant mechanical superintendent of the Erie Railroad and of its operated and controlled lines.

Mr. J. H. Abrams has been appointed Trainmaster of the Washington division of the Southern Railway, vice W. S. Andrews, promoted.

Mr. Ira Southwick has been appointed master mechanic of the Toledo & Western, with headquarters at Sylvania, Ohio, vice Mr. J. Cunningham, resigned.

office at South Terminal Station, Boston, Mass.

Mr. H. E. Passmore has been appointed master mechanic of the Western division of the Toledo & Ohio Central Railway, vice Mr. J. C. Homer, resigned.

Mr. J. G. Platt has been appointed engineer of tests on the Erie, with office at Meadville, Pa., vice Mr. A. G. Trumbull, appointed mechanical engineer.

Mr. William Apps has resigned his position of master car builder of the Algoma

Mr. C. W. Spencer has been appointed General Superintendent of Transportation on the Canadian Pacific Railway over all lines east of Port Arthur, with office at Montreal.

Mr. W. C. Hayes has been appointed assistant mechanical superintendent of the Erie Railroad, and of its operated and controlled lines, vice Mr. George Donahue, resigned.

Mr. F. P. Barnes, master mechanic on the Santa Fe at Albuquerque, Cal., has

resigned to accept the position of superintendent of motive power on the El Paso & Northeastern.

Mr. Charles Day, of the firm of Dodge & Day, modernizing engineers, of Philadelphia, recently read a paper on "Machine Shop Methods," before the S. K. C. Club, at Pittsfield.

Mr. E. Hacking has been appointed master car builder of the Algoma Central & Hudson Bay Railway, with headquarters at Sault Ste. Marie, Ont., vice Mr. W. Apps, resigned.

Mr. Arthur Piers has been appointed manager of steamship lines, with charge of all the steamships owned and operated by the Canadian Pacific Railway Company. His office will be at Montreal.

Mr. C. M. Stourbraker, formerly of the Rock Island route at Colorado Springs, has been appointed assistant trainmaster on the Illinois Central Railroad, with headquarters at Carbondale, Ill.

Mr. F. P. Brady, formerly superintendent Canadian Pacific Railway, at Fort William, has been appointed assistant general superintendent of the Central division of the same road, with office at Winnipeg, Man.

Mr. Robert Streghorn has been appointed general foreman of the Fort Worth shops of the Fort Worth & Rio Grande, vice Mr. H. Ebert, who has resigned to accept a position on the Texas Midland.

Mr. I. C. Hicks, formerly foreman of the Minneapolis shops, of the Minneapolis & St. Louis, has been appointed general foreman of the San Bernardino shops, on the Santa Fe coast lines, vice Mr. Werst, resigned.

Mr. Thomas Outhouse, who as foreman at Cairo, Ill., on the Mobile & Ohio, resigned to take his run again on the road, has been appointed general foreman for the same road, with headquarters at Meridian, Miss.

Mr. John B. Thayer, Jr., has been appointed fifth vice-president of the Pennsylvania Railroad. He has been on that road since 1883, and is not only thoroughly familiar with the whole system, but he is a trained traffic officer.

Mr. J. Oborne has been appointed general superintendent of the Eastern Division of the Canadian Pacific Railway, with office at Montreal. Mr. Oborne was formerly general superintendent of the Atlantic Division of the same road.

Mr. Geo. Spencer, formerly chief train-dispatcher on the Canadian Pacific Railway, at Toronto, has been appointed Superintendent of the line between Smith's Falls and Hamilton, vice Mr. J. Manson, transferred. Office at Toronto.

Mr. J. A. Doarnberger, master boilermaker on the Norfolk & Western Railway, at Roanoke, Va., has been elected president of the International Railway Master Boiler Makers' Association, at its last annual meeting, at Columbus, O.

Mr. R. H. Soule, the well-known superintendent of motive power, who has been a long time confined to his home with sickness, is now entirely recovered and intends resuming the business of consulting mechanical engineer in New York City.

Mr. J. E. Mulfeld, heretofore superintendent of motive power of the Baltimore & Ohio, at Newark, Ohio, has been appointed general superintendent of motive power for the same company, with headquarters in Baltimore, Md., vice Mr. F. D. Casanave, resigned.

Mr. W. A. Gardner, assistant roundhouse foreman at the Altoona shops of the Pennsylvania, is the inventor of the patent locomotive sander which we illustrated in our June issue, page 252. The name of Andrews mentioned in connection with it was introduced by mistake.

Mr. William Burlingham has accepted an appointment as chief engine designer with the B. F. Sturtevant Co., of Hyde Park, Mass., resigning a position in the United States Inspection Office, with the Wm. R. Tigg Co., of Richmond, Va. Mr. Burlingham has previously been associated with the Bath Iron Works, the General Electric Co., the Southwark Machine & Foundry Co., and the Newport News Ship-Building & Dry-Dock Co. He has also served on Mr. T. A. Edison's staff at the East Orange laboratory, and is a graduate of the Worcester Polytechnic Institute.

Mr. Wm. Downie, heretofore superintendent on the Canadian Pacific Railway at Nelson, B. C., has been appointed general superintendent of the Atlantic division of the same road, with headquarters at St. John, N. B., vice Mr. J. Oborne, transferred. Mr. Downie is a native of Rock Currie, Ireland. He entered railway service in Canada in 1869 and was employed in the telegraph department of the Northern Railway of Canada. He held various positions of importance, and when the C. P. R. opened their transcontinental line in 1886 Mr. Downie was appointed assistant superintendent of the Pacific division. He subsequently became superintendent of the same division, and later on was appointed superintendent C. P. R. lines and steamers in the Kootenay district, B. C. His many friends wish him every success in his new and enlarged field of labor.

Mr. W. Lavery has resigned his position as assistant superintendent of motive power on the Erie, to accept the position of general superintendent of the Railway Steel Springs Company, at Oswego, N. Y. Mr. Lavery has seen a good deal of active railroad service, being at various times master mechanic on the New York, Pennsylvania & Ohio, at Gallion, O.: master mechanic on the New York, Lake Erie & Western Railway, at Meadville, Pa., and also at Susquehanna, Pa.; later assistant superintendent of motive power on the same road. When the Erie took over the N. Y., L. E. & W. Mr. Lavery went with the road, and was subsequently assistant superintendent of motive power for lines east of Salamanca on the Erie. He has long enjoyed the reputation of being an exceptionally good shop manager.

Mr. F. D. Casanave has resigned from the position of general superintendent of motive power of the Baltimore & Ohio, to accept the position of assistant to Mr. Theo. N. Ely, chief of motive power of the Pennsylvania Railroad. He had been connected with the Pennsylvania Railroad since 1862, at which time he began as an apprentice in the Altoona shops of that company. After holding various responsible positions and doing special work in the motive power department, he was, in 1876, made assistant master mechanic at Altoona. In 1881 he took charge of the Pennsylvania Company's shops at Fort Wayne, Ind. In 1887 he was promoted to the position of superintendent of motive power of the Northwest system of the Pennsylvania lines west of Pittsburg, and in 1893 he became general superintendent of the Pennsylvania Railroad. Subsequently he was appointed to the position which he has just relinquished. Mr. Casanave was one of the pioneers in adapting piece work prices to new and repair work in railroad shops, and is one of the ablest motive power men in the country.

The Westinghouse Company's publishing department, Pittsburg, Pa., has just issued a neat little pamphlet of their industrial series, "Electricity in Mining." The first few pages are devoted to the consideration of the economy which follows from the use of electrical power in the various operations which have to be performed in the work of mining. Good half-tones are used to illustrate the necessary power plant, the generators, the motors, the controller and the Baldwin-Westinghouse electric mining locomotive. The matter of haulage is next taken up, explained and illustrated. Hoisting is touched on and the requisite machinery and equipment is illustrated. Pumps and air compressors form the subject of the next section, illustrated as are the others. Fans and blowers follow, with paragraphs on drills and coal cutters, lighting, and machine shop tools, etc. Some observations on placer mining and the way in which electrical power may be employed closes the pamphlet.

The Westinghouse Electric and Manufacturing Company, of Pittsburg, Pa.,

will be very happy to forward this interesting little publication free to anyone who will drop them a line asking to have it forwarded. A postal card will do the business.

The Gold Car Heating and Lighting Company has brought a suit in the United States Circuit Court, Northern District of Illinois, at Chicago, against Egbert H. Gold, for infringement of United States Letters Patent No. 388,772 for car heating apparatus.

European Notes.

It is abundantly clear that limits have not yet been placed to the provision of greater locomotive power for express traffic in Britain. We have witnessed some startling developments in this direction during the past few years on most of the British trunk lines, culminating in Mr. McIntosh's large locomotive referred to in a previous number. There is reason to believe, however, that the Caledonian engine will hold record for a very short time, as rumor has it that the latest North-Eastern express locomotive will be of surpassing dimensions. Little information is forthcoming at present with regard to the engine, but it has been stated that it is to be a four cylinder compound on the du Bousquet-de Glehn lines, with two 15-inch high pressure and two 25-inch low pressure cylinders. Such figures as these are sufficient to indicate that the provision for steam generation must be far greater than anything yet seen in Great Britain. Indeed, it is said that the boiler will so approximate to the lines of the loading gauge as to leave no room for any visible chimney, steam dome or safety valves. In view of the prevailing diversity of practice one point of interesting speculation is the number, size and disposition of wheels. There appears at present a prepossession in Europe for the 4-4-2 or "Atlantic" type, but some recent remarks of Mr. G. J. Churchward, of the Great Western Railway, would seem to point to the possible adoption in the near future of the 2-6-2 or "Prairie" arrangement, now in common use in several British colonies. If such is to be the case, we shall doubtless soon witness a further step to the 4-6-2, or "Prairie" with leading bogie, and, it may be, to 4-6-4, that is, six-coupled engines with leading and trailing bogies.

Mr. Churchward has just turned out his first express engine. This is a 4-6-0 type, different in several respects from the No. 100 class built last year by Mr. Churchward's predecessor, Mr. Dean. The cylinders are 18 inches by 30 inches stroke, placed outside and provided with piston valves. The boiler barrel is 14 ft. 10 ins. long and is coned or tapered for nearly half its length. The heating surface provided measures 2,143 sq. ft. and the fire grate area 27.22 sq. ft. The six-coupled wheels are 80½ ins. and the bogie wheels 38 ins. in diameter. An interesting feature is that brake shoes are supplied to the bogie wheels as well as to each of the coupled wheels. The working pressure is 200 lbs. and the tractive force 21,734. In full order the engine and tender weigh 249,760 lbs., of which 116,480 lbs. are available for adhesion.

Another interesting type of locomotive just put into running is a six-coupled, four-cylinder compound goods engine with a four-wheeled leading radial truck, designed by Mr. Webb for fast goods traffic on the main lines of the London and North-Western. These engines have 60 in. coupled wheels, two H. P. cylinders 15x24 and two 1 L. P. 20½x24, heating surface 1,753 sq. ft., grate area 20½ sq. ft., total weight in full order with tender, 205,000 lbs. They are a decided advance on the 51 in. eight-coupled, four-cylinder compound goods engine so extensively employed on this road, and Mr. Webb is to be congratulated on what may prove to be his last great work for the company.

Mr. J. G. Robinson, the able and enterprising Chief Mechanical Engineer, who has done so much to bring the stock of the Great Central up to modern requirements, has designed a new class of tank engines for that line which are being built by the Vulcan Foundry Company, of Newton-le-Willows, Lancashier. The general appearance of these locomotives can be gathered from the photograph. The driving wheels are 67 in. diameter, cylinders 18 in.x26 in., total wheel base 29 ft. 10½ in. total heating surface 1,143 sq. ft., grate area 19.85 sq. ft., total working weight 142,000 lbs.

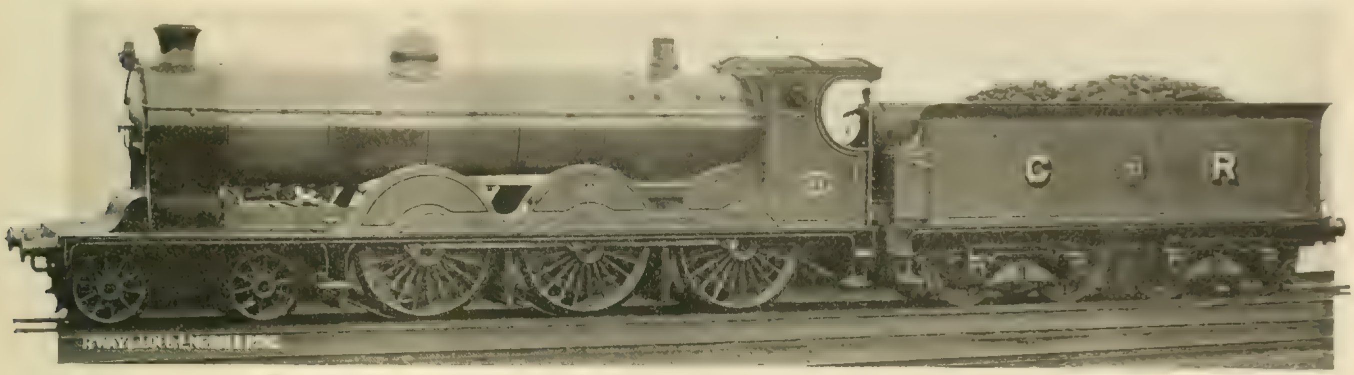
Some powerful express engines are being turned out of the North British Railway shops at Cowlairs, designed to cope with the constantly increasing loads to be hauled at high speeds over exceptionally difficult sections.

It is stated that the de Glehn compound (4-4-2 type) now being built at Belfort, by the Société Alsacienne de Constructions Mécaniques, for the Paris-Orleans Railway, will weigh at least 164,000 lbs. in working order exclusive of the tender, or 18,000 lbs. more than the Nord engines of a similar type.

Excellent work is being done on the Adriatic lines of Italy by the Borsig six-coupled compound engines which run with the firebox in front. Loads of 400 (long) tons are hauled with ease at 45 miles per hour upon roads constructed of light rails, with grades of 1 in 83 and a plentiful supply of sharp curves. On a recent occasion with a net load of 380 (long) tons a speed of 43 miles per hour was attained in three minutes. The admission to the cylinders was full in starting and reduced to 15% off after a few revolutions, which was then maintained throughout with regulator three-eighths to half open. A speed of 56 miles per hour was attained without effort on level stretches. The facility of starting possessed by these engines is very remarkable.

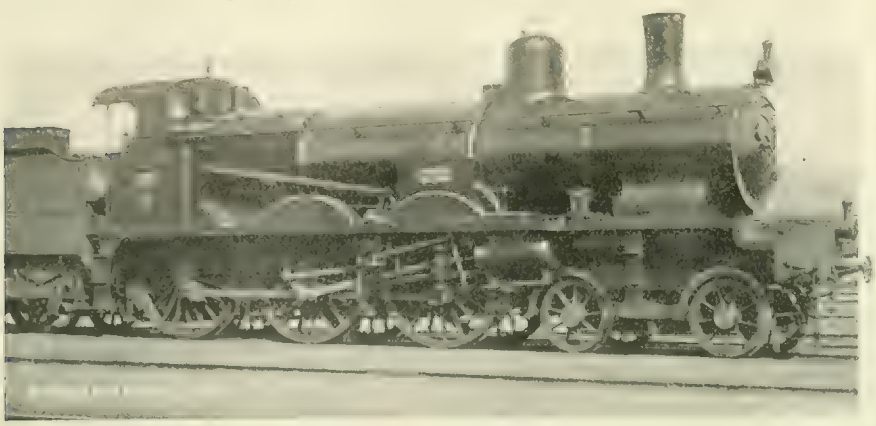
Mr. Borsig (Berlin) has secured an order from the Portuguese State Railways for some six-coupled, four-cylinder compound locomotives for the 5 ft. 6 ins. gauge, which are to be in running at the fall of the year.

In the Spanish portion of the Peninsula, the Vasco-Castellana Company is doubling its line from Bilbao to Burgos,



POWERFUL TEN-WHEEL PASSENGER ENGINE ON THE CALEDONIAN RAILWAY

125 miles. The line will be continued from the latter point to Madrid, which will shorten the journey between Bilbao and the capital by 90 miles in distance and eight hours in time. A contract for eight locomotives has been secured by a German firm. According to a recently published report of the British Consul at Bilbao, the locomotive engineers of two lines in Northern Spain have pronounced against American-built engines, stating that their fuel consumption is greater and their handling power less than that of British locomotives. In this connection it is interesting to note that for what is probably the first time on record an American line is purchasing engines from Europe. The Saxon Locomotive Works, Chemnitz, Germany, has in hand for the Canadian Pacific twenty two-cylinder compounds for passenger service, type 4-6-0, the total working weight of which will reach 330,000 lbs., inclusive of tender.



FOUR-CYLINDER COMPOUND—DU BOUSQUET-DE GLEHN TYPE

Some very powerful six-coupled tank locomotives with radial axles fore and aft have recently been supplied to the Berlin Metropolitan Railway by the Berlin Locomotive Works. These are of the 2-6-2 class and have three H. P. cylinders —two placed outside the frames driving the second coupled axle and one inside the frames driving the leading coupled axle. The coupled wheels are 59 ins. diameter and the wheel base 29 ft. 6¼ ins. To supply live steam to three cylinders 19¾"x24¾", a total heating surface of 1,667 sq. ft. is provided, which would seem to be but moderate provision for the purpose. With about 16,000 lbs. of water and 5,600 lbs. of coal the engine weighs 175,000 lbs.

About ten miles south of the Arctic circle, from the harbor of Moigranen on the Ranen Fjord, Norway, for 17 miles up the Dunderland River runs the 4 ft. 8½ in. gauge railway of the Dunderland Iron Company, now nearing completion. Orders were placed last year for the necessary locomotive power for this high latitude line, the contract being divided between Messrs. Robert Stephenson and Co., of Darlington, and Messrs. Kerr, Stuart and Co., of Stoke-on-Trent, the former securing an order for two light locomotives, and the latter for two of heavier design. Particularly smart work marked the execution of the orders, Messrs. Kerr, Stuart and Co. being especially prominent in this direction. Their engines weigh 67,500 lbs. each and exert a tractive force of 18,700 lbs. when cutting off at ¾ stroke. The contract for the steel hopper cars for this line went to the Pressed Steel Car Co., Pittsburg.

With reference to the all-absorbing topic of electricity versus steam for tractive purposes, the British House of Commons Committee which had under consideration the part-tube-part-surface scheme of electric traction in the east of London known as the City and North East Suburban, after a somewhat protracted hearing, rejected the proposal on financial grounds, much to the satisfaction of the Great Eastern Company, whose enormous ten-coupled experimental tank engine has on further trials more than justified anticipations. One result of this fizzle-out of an electric scheme is certain to be that the financial considerations will be gone into by the committees first of all. Meanwhile the almost hopeless imbroglio of schemes to improve the conditions of London traffic awaits the findings of the Royal Commission on the subject.

Scarcely one of the British railways has escaped the "electric flood" which in many directions threatens destruction of their short distance traffic. By skilful amalgamating or co-operating arrangements some of the electric tramways now in existence, such as those in South Lancashire, the Potteries, the Newcastle district and West Yorkshire, have attained to the dignity of inter-urban systems and there is now no doubt in the minds of railway officials that the danger is real. Among the various schemes for meeting the competition, one which is daily gaining ground is the provision of steam "units" in the shape of steam carriages, a revival of early railway practice, as will be seen by the photograph. The London and South Western has lately placed such a car on a section of its system, and other lines such as the Great Western, Great Eastern and London, Brighton and South Coast have either already moved in the same direction or have the matter under consideration. Others, more bold, are using electricity against electricity. Most interesting and startling developments may with confidence be expected. As a contribution to the prevailing fever, some enthusiasts are calling on the railways not only to use road motor vans for the collection and delivery of goods, but to give passengers the same facilities for reaching and leaving the railway stations.

The severity of electric competition is also being felt by steam lines in Scotland, France, Italy, Germany and Austria. In the latter country, Herr Goldsdorf of the Austrian State Railways has decided to put into competition with the steam, electric or petrol motor cars which it is proposed to introduce on some of the branch lines, the exceedingly interesting little locomotive of which we give a photograph. This is a two-cylinder compound using oil fuel on Holden's patent system. It weighs 33,600 lbs. and is capable of hauling two cars, weighing 22 long tons, up a grade of 1 in 200 at a speed of 40 miles an hour or a load of 45 long tons, up 1 in 100 at 16 miles an hour. The results of working are said to be very encouraging, and the experiment is being watched with considerable interest, the use of heavy fuel oil for steam generation on a service of the kind being distinctly novel.

Meeting of Safety Car-Heating and Lighting Co.

A meeting of the board of directors of the S. C. H. & L. Co. was held at that company's New York office on June 10 and the following officers were elected for the ensuing year: Robert Andrews, president; R. M. Dixon, vice-president; D. W. Pye, 2d vice-president; C. H. Wardwell, secretary and treasurer; I. P. Lawton, assistant secretary and treasurer. At the same meeting the regular quarterly dividend of 2% and an extra dividend of 1% were declared. This dividend will be payable July 1.

The annual report of the company showed that the past year had been a most prosperous one, both in the lighting and heating departments and the prospect for the coming year is a particularly bright one. Further facilities for the supply of Pintsch gas are being provided for by the erection of new manufacturing plants at Philadelphia, Harrisburg, Altoona, Columbus, and the capacities of many existing plants are being increased, notably Jersey City, Pittsburg, Kansas City, Washington, Atlanta, So. Louis and Mott Haven, at the four latter named points the old works being abandoned and entirely new works being constructed.

The steam heating business of the Safety Co. has shown a gratifying increase.

On the Santa Fe Trail.

BY ANGUS SINCLAIR.

It has been my good fortune to ride over vast stretches of country in different parts of the world, and a long journey gives a striking impression of the earth's magnitude, but I have never traveled on an unbroken journey which made such vivid impression of the vastness of the world we live in, as the ride of 1,570 miles from Buffalo to La Junta, Colorado. Almost the whole stretch is through a flat or rolling country, with no forests, and the traveler seems all the time to be looking into illimitable space. I have traveled as far through Germany and Russia over flat wastes which were wooded to a great extent. There the impression given was how much desolation there is on the earth's surface. The trip to Colorado conveyed no idea of that kind, for there are always in sight evidences of man's industry, thrift and energy in home making, the proofs that all over that vast region human labor has within a few years converted wildernesses into fruitful farms.

The journey from Chicago to the foothills of the Colorado mountains is not one which a searcher after scenic attractions is likely to select, but it has its own good points which are numerous and substantial. To start out with we follow for about thirty miles the course of the Chicago drainage canal, a huge undertaking. The canal, a rather unsavory stream which can be felt without being seen, diverts a good sized river from flowing into Lake Michigan, and carries its water along with the odorous sewage of Chicago through the natural watershed to the Mississippi slope. The thriving city of Joliet commands some attention, with its increasing manufactures and prosperous penitentiary, where many Chicago criminals, high and low, find homes removed from temptation and where many others ought to be sheltered.

If our people had any regard for names that would be cherished in other countries, the doings of Louis Joliet, after whom the town was named, who first explored the Mississippi Valley, would be a household story. The State of Illinois has honored several of the early French explorers by naming places after them, but nothing is done to make school children familiar with the deeds of Joilet, Marquette, La Salle and others.

The train spins merrily along through an ideal farming country that looks as if it might be the granary of the land, as Egypt used to be for the ancient world. This was an ideal region for railroad building and for railroad operating. No great excavations needed to pierce hills and bluffs, no expensive embankments to make level track through gulleys and earth depressions. Enough earth scraped up from the deep black loam to keep the roadbed above water was generally all that was necessary. It is hard to understand for what purpose the demand for very heavy locomotives arose to pull trains in this part of the country, since a good mogul or ten-wheel engine could haul all the cars that could be comfortably kept together.

The number of thriving towns and villages passed is surprising for an agricultural country, but beneath some of these prairies and corn-covered ridges are rich deposits of bituminous coal, which always stimulate manufactures by providing cheap power.

Several persons in our car have never seen the Mississippi River, and long before we reach its banks we hear repeated inquiries about when the Father of Waters will be seen. It is wonderful how keenly most people are to see for the first time a great river, and more especially the Mississippi, and how uniformly they are disappointed with the sight. The only rivers that I have seen which were not disappointments, were the Niagara River, between Buffalo and the Falls, and the Danube, at Vienna. The first time I saw the Mississippi was at Quincy, in the late fall, when the water was very low, and I felt not only disappointed, but indignant that it did not expand a little to meet my expectations.

On this trip the waters were more in evidence and expressions of delight were heard as we crossed the fine eight-span bridge that lands us at Fort Madison, in Iowa. At this place we get a glimpse of the northern repair shops of the Santa Fé, which were a model establishment seven or eight years ago. They have been extended considerably since that time, and I believe are operated no less efficiently than they were when Mr. Thomas Paxton was in charge.

The corner of Iowa crossed is a country with more uplands and more trees than we found in Illinois, and railroad builders found something more to do in forming a fairly straight and level roadbed. The indications of industry and thrift, however, continue, and we see no perceptible difference when we cross the line into discredited Missouri.

A considerable part of the passengers in our car are on their way to California for the first time, and are out for all they can see. Acquaintanceship has spread from seat to seat, and by the time the Mississippi was reached some of the women were able to tell something about everybody in the car, where they came from and whence they were bound. Before the journey was over the society of our little world had differentiated itself into separate social elements, which represented the high, the middle and the low grades of its society. At first our society was elemental and democratic, with no one making pretensions over the others. That lasted throughout the first day and reminded me of the relations that existed between Cæsar and Luath in Burns' Twa Dogs, who were

* * * "fain o' ither,
And unco pack and thick thegither."

General interest was manifested in the coming sight of the Mississippi river, and I reached the height of my popularity during the journey by being able to tell what was coming. My memory was at fault, however, and I told that we came suddenly upon the river through an opening in the bluffs and crossed it on a high bridge nearly a mile long and 150 feet high. When we ran through the rough, hill-bound valley at times in sight of the river for more than an hour before crossing, my short-lived popularity died and I could not help feeling that several of the people regarded me as a fraud throughout the rest of the journey.

The Missouri River's surroundings are decidedly picturesque when first introduced to the Santa Fé traveler, although it still deserves Bob Burdette's description of being "the most dusty stream in creation."

The party in our car had Christian Endeavor proclivities, and as we approached Kansas City they expressed their intention of going out of the train as soon as it stopped, to put their feet upon the sacred soil of what had been Bleeding Kansas. The ground outside the station was muddy, but several women stepped bravely in. They looked resentful when I

WEBB FOUR-CYLINDER COMPOUND GOODS ENGINE

mentioned after we had started that they had anointed their brogans with Missouri mud. When travel is left to teach us geography, the refinements of exact boundaries are frequently overlooked.

It is a wonder to me that writers of fiction have failed to make Kansas City and its surroundings the theater of some stirring romance. Perhaps a truthful tale of what happened in this bluff perched city and the country round about, makes romance enough without any help from the imagination.

Leaving the great city, a veritable metropolis of 225,000 inhabitants, with its stock yards and packing houses and other vast magazines storing the fruits of the soil, we steam away through a highly diversified landscape along the valley of the Kansas River for many miles. No wonder that there was hard fighting for the possession of this country, and no wonder that the aboriginal inhabitants clung to it tenaciously and moved backwards with hate in their bosoms.

The Santa Fé trail now leads us through very different scenes from what were witnesed when courageous men took their lives in their hands and braved terrible dangers and endured untold hardships to act as the missionaries of commerce. All along the trail have sprung up prosperous towns and villages stirring with industrial activities, where a great and growing population is regenerating human shortcomings by applying the gospel of labor to their lives. Kansas air is dancing with hysteria, but its people neutralize levity by hard work.

We gaze with interest upon the thriving city of Lawrence, whose youth suffered and bled, while bearing the brunt of the conflict which made Kansas a free State. In passing we get a glimpse of Lecompton, the first capital of the territory, where Border Ruffians long held sway and Free Soilers strove for control. Soon comes the fine city of Topeka, the capital of the State, and of special interest to railway people as being the mechanical headquarters of the Santa Fé system. Here Mr. George R. Henderson, superintendent of motive power of the company, holds sway over an industrial community that makes a town in itself.

As we advance into the State we recall the eloquent words of Senator Charles Sumner uttered during the conflict against imposing slavery upon the territory. "Take down your map," he exclaimed, "and you will find that the Territory of Kansas, more than any other region, occupies the middle spot of North America, equally distant from the Atlantic on the east, and the Pacific on the west, from the frozen waters of the Hudson Bay on the north, and the tepid Gulf Stream on the south, constituting the precise territorial center of the whole vast continent. To such advantages of situation, on the very highway between two oceans, are added a soil of unsurpassed richness, and a fascinating, undulating beauty of surface, with a health-giving climate calculated to nurture a powerful and generous people worthy to be a central pivot of American institutions."

We have been for hours traversing fertile plains that geology tells were once the bed of an inland sea. Its leavings are more potent than Byron's "red rain that made the harvest grow." But the surfaces of these green plains are not the only source of riches that give energy to the thriving towns by the wayside. There are rich coal measures and free yielding salt mines in various parts, the flourishing town of Hutchinson thriving on salt industries.

For a long time the trail follows the Arkansas River, whose bed was well filled with water. In dry seasons this stream disappears for many miles, leaving beds of sand and gravel to disappoint the thirsty traveler.

Although the general appearance of the country is level, there are ridges of considerable height to be surmounted at times, and in going westward there is a steady rise toward the Rocky Mountains. It is not surprising then that the locomotive in front of the train is frequently heard to be toiling hard and the train moving along quite deliberately.

When I first went through on this line engines were smaller than they are today, and the trains moved rather slowly up the grades. There were many cowboys in the western countries and their free and easy ways were amusing to the passengers. They used to ride alongside of the track and hold a running conversation with the inmates of the cars. The story was told of a cowboy named Tom Hyde who had become notorious for the freedoms he took with the passengers. One day Tom rode alongside making love to the ladies at the windows and chaffing the men. As they approached the top of the grade Tom began saying his adieux, when a gentleman at an open window asked the cowboy to shake. Tom was only too willing, and found his hand grasped as in a vise. Tom wanted to quit, but the passenger kept his hold, saying pleasant things about his admiration for cowboys. The top of the grade was passed and the train soon began gaining speed. Presently it was too rapid for the cowboy's broncho and Tom was dragged from its back and was held dangling on the side of the car like a polecat nailed to a barn door. The passenger with the iron grip watched his chance, and when the train was passing a muddy water hole the cowboy was dropped in, amidst the shouts of his friends, who rode up in time to prevent him from perishing in the mud.

After a short delay at La Junta, our part of the train turns south toward the mountains, and the other part keeps on toward Denver. The mountains are now moving out of the horizon and our friends are all on the *qui vive* to miss none of the sights.

At the Altoona shops there are 21 vestibuled passenger coaches, and nine 60-foot baggage and express cars being built. In the Allegheny shops there are eight baggage and express cars under construction. Fifteen new cars for the northwest system are also being built at the Columbus shops as follows: Four 70-foot combination coach and baggage, four 60-foot postal, three horse express cars and four baggage cars. This equipment is additional to a large order for passenger coaches recently placed with the Pullman company which will likely be ready for delivery within a few months. The new equipment will afford the lines west, ample facilities for handling the gradually-increasing business.

Locomotives propelled by electricity drawn from the air without cost, and ocean liners racing over the sea by the agency of the electric current drawn inexpensively from the same source, are promised for the near future by Tesla. It is to be done on the principle of wireless telegraphy. Tesla is very much of a visionary, but he has done great feats. and if he succeeds in making power out of nothing, so to speak, the world will reap the benefit.

The announcement is made that the Columbus, London & Springfield road will soon introduce a new feature in electric railroading. It received an electric locomotive some time in May, to be used for all kinds of heavy hauling. It will probably be placed into service in assisting the motor cars in handling heavy trains of excursionists.

Certain independent coal operators in West Virginia are suing the West Virginia & Northern for about $90,000 damages on account of the railroad company not supplying them with the proper share of cars for the shipment of coal.

The Kennicott Water Softener Company have secured the services of Prof. Bruce, who was formerly connected with the University of Chicago. He will have full charge of the laboratories of the company.

We never know wot's hidden in each other's hearts; and if we had glass winders there, we'd need to keep the shutters up, some on us, I do assure you.
—*Mrs. Gamp.*

Human judgment is never infallible.
—*Sketches by Boz.*

The Suburban Car Seating Problem.

There is not much likelihood of any change in the seating arrangement of the ordinary steam railroad coach, but the future will very probably see considerable alteration not only in the seating capacity, but also the door arrangement of the suburban car. A typical example of the suburban car which wastes space and is not convenient for passengers may be seen on the Manhattan Elevated Railroad in New York, where seats are arranged along the sides of the car with four "square pews" in the center. These cars have end doors, many of them swinging, and the car seats 48 persons. The suburban cars on the Illinois Central have side seats and six "square pews" in the center of the car, and hold 56 people. This latter road, however, is working on plans for the introduction of suburban cars in which the full floor space will be used for seats with the exception of that used as a narrow aisle. Four plans of seat arrangement have been thought of, and in these cars side doors will be a prominent feature.

The first plan has rows of seats arranged back to back across the floor of the car with a narrow aisle down one side, and side doors on the aisle-side of the car, opposite the passageway between the seats. Such cars are suitable for roads with terminal loops and station platforms outside the tracks. This style of car would seat 120 persons.

The second plan is similar to the first and holds as many people, but has side doors at both sides of the car. This arrangement is suitable to roads without terminal loops, as passengers can enter or leave the car from either side.

The third plan provides for the seating of 115 passengers, and is a modification of the ideas embodied in each of the preceding plans. The aisle runs up one side to the center of the car with side doors only along the aisle. A cross-over passage in the middle of the car connects with the aisle and doors down the other side. A loss of five seats is necessary, owing to the introduction of the cross-over passage. This car would be suitable for constant traffic of moderate volume in which people enter and leave from both sides.

The fourth plan is drawn with two side aisles and side doors along each side, seats being arranged across the car floor as in the other plans; 96 persons can be accommodated. This plan is intended to deal with rush-hour traffic, which is very heavy and where a train has frequent stops.

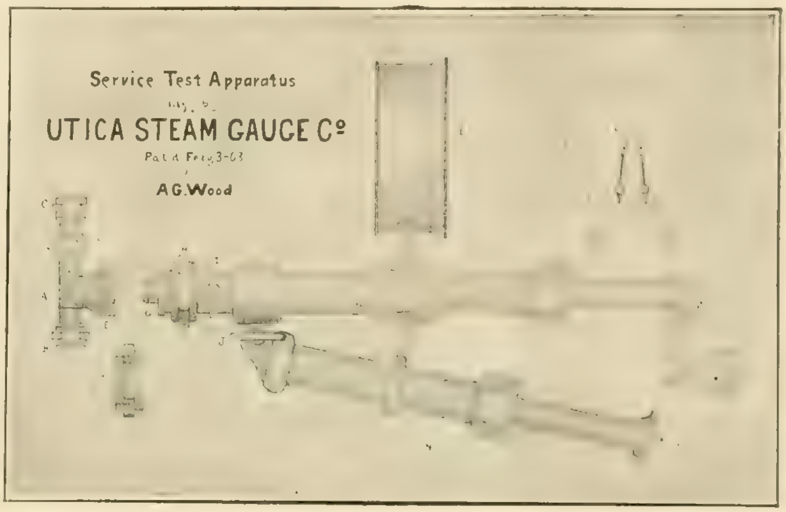
The salient features of all these plans, any of which is vastly superior to existing suburban car arrangements, are that more people can be comfortably accommodated—given, except in extreme cases, what they pay for—seats. The time required for the filling and emptying of such cars is greatly reduced, probably to ten seconds, by reason of the sliding side doors, there being one door for every ten persons. A long car will not take more time to empty and fill than a short one will. Persons can enter by any door and find a seat anywhere in the car after it has started, by reason of the aisle arrangement. The liability to accident is reduced by reason of the fact that the side doors slide on rollers and are operated by compressed air, so that they are not opened until the car is fully stopped and are all shut and latched before the train starts. There being no footboards along the sides and no handgrabs, there is no means by which a belated traveler can hang on outside.

During rush hours, when standing room is precious, the proposed cars present great advantages. As the movement of passengers getting on and off is across the car floor, the space in the main aisle between seats is available for standing without blocking the in and out movement, and even if this movement is interfered with it can only be impeded by two or three people who can easily step temporarily out of the car and so clear the way. The ends which form the passage to the vestibules can also accommodate several "standers." The people who are thus compelled to stand have the seat backs to grasp, and are not huddled together in an almost impenetrable, swaying mass, holding on to loose straps.

These plans show an intelligent effort to grapple with pressing transportation problems and to increase the safety, ease and facility of suburban travel, and at the same time they greatly increase the legitimate earning power of each car. They reduce time at stations and put most of what time there is occupied on the trip into *carrying people*, and not in compelling them to use more time than they wish to use in fighting their way on and off. The conceptions involved in modern cars such as we have described, when put into wood and metal and operated through the suburbs of the Windy City will contrast very sharply with the *laissez faire* policy which permits new cars seating 48 to 56 persons to be built and introduced on modern crowded urban lines, with all their old fogy, discomfort and delay-producing features.

Steam Gauge Service Test Apparatus.

The Utica Steam Gauge Company, of New York, have recently placed on the market a service test apparatus which is intended to enable a man to test locomotive and other steam gauges without taking them off the boiler. The apparatus, however, requires a special connection of gauge to boiler which only differs from the standard connection in that it has a threaded flange to which the testing machine may be attached, and this flange is covered with a cap nut under ordinary circumstances.



GAUGE SERVICE TEST APPARATUS FOR LOCOMOTIVES.

When it is desired to test a locomotive gauge the procedure is as follows: Close the cock F, remove the cap nut D and place the end of the apparatus G on the connection E, fastening it in place by means of the union nut H. Open the cock I and the cock J and push in the plunger K until an initial pressure is established on the test gauge L of say 20 pounds or any desired pressure. This introduces enough liquid into the test barrel to continue the work. Then close the cock J and operate the screw plunger M as with any ordinary test pump, exerting any required pressure upon the test gauge L and the same pressure being also exerted on the gauge being tested. When the test has been completed to as high a pressure as desired, open the cock J slowly and the pressure which is then on the apparatus is exerted against the piston N, which pis-

ton is provided with a small by-pass in order to form a cushion so that the plunger K will retract moderately and not return with a sudden thump. Now close the cock I and disconnect the apparatus, replace the cap nut D and open the cock F slowly, admitting the boiler pressure to the gauge, and it is again in service.

When it is desired to make a quick test for running pressure when time is limited, attach the apparatus as above described, slowly open the cock F and slowly open the cock I, allowing the boiler pressure to be exerted carefully on the entire apparatus. If the gauge in service agrees with the test gauge L it is certainly correct for the running pressure. Close cocks F and I and disconnect. The apparatus has been patented by Mr. A. G. Wood.

When Railroad Companies Provided Trainmen with Watches.

Railroad companies have always been strict about engineers and conductors carrying good watches, but in early days of train operating the employers took the responsibility of supplying good, reliable watches to the men. In the British Isles the guard or conductor used to be provided with a big watch which was secured in a leather case and strapped around the holder's neck.

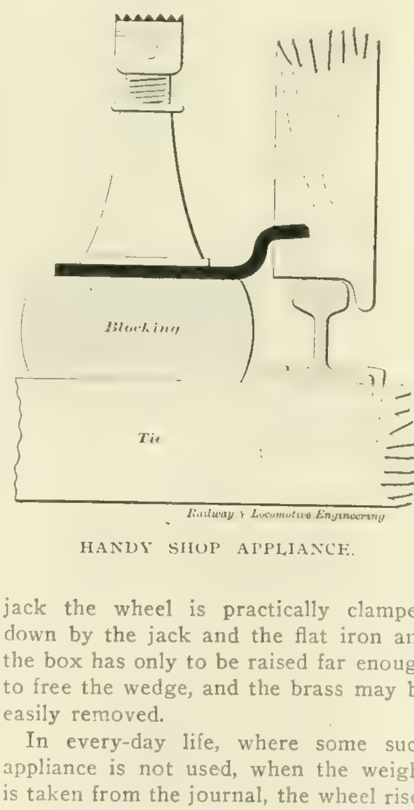
When the Camden & Amboy was first operated the engineers and conductors were provided with watches by the company. If an engine broke down and the train was taken by another engine, the engineers exchanged watches. When an engine was ordered to go out the engineer went to the dispatcher's office and turned in his watch and received another set by the standard time clock. But those days when the companies took the responsibility of having their trainmen keep correct time are gone never to return.

A. Leschen & Sons' Rope Company, of 920 North First street, St. Louis, Mo., have recently issued an illustrated catalogue which gives a good deal of information about wire ropes in general and shows exactly what the patent flattened strand wire ropes are, which are a specialty of this company. The flattened strand rope is said to be free from all tendency to spin or kink, and a saving in the wear of pulleys and sheaves is effected by the smooth surface of the rope. The company also make all kinds of cables, sash cord, galvanized steel hawsers, rope hooks and couplings, suspension bridge cables, switch ropes for railways, rope sockets, thimbles, guy shackles, rope clamps, turnbuckles, chain, steel or malleable blocks, snatch blocks, sheaves, wire ferry travelers, tackle blocks, etc., etc. There is a table of transmission of power by wire ropes and some observations on wire rope transmission. Directions for making splices are given with diagram and the necessary tools are enumerated. Send to the Leschen Company if you would like a copy of the catalogue.

A Handy Rig.

A handy rig for assisting the busy car repairer or round-house man when jacking up an axle box to take out a brass is here described. It consists of nothing more than a piece of heavy flat iron, say ¾x4 in., cut to a convenient length and lipped up at one end so as to rest on the rim of a wheel as shown in the illustration. The long flat portion of the iron bar is laid upon the blocking and supports the jack.

When pressure is applied to the underside of the axle box by working the



HANDY SHOP APPLIANCE.

jack the wheel is practically clamped down by the jack and the flat iron and the box has only to be raised far enough to free the wedge, and the brass may be easily removed.

In every-day life, where some such appliance is not used, when the weight is taken from the journal, the wheel rises up off the rail owing to the weight of the car resting on the journal at the other end of the axle and usually the wheel has to be held down by a helper who often does a sort of fantastic teeter-tauter act at the end of a long wooden lever or a pit plank before the wedge drops below the lugs in the box roof. Time and labor may be saved by the use of this handy little jack attachment, and the helper can be otherwise employed or at least can preserve his personal dignity during the operation, and that may be worth something at a crowded passenger station when working against time with a hot box, amid highly interested onlookers.

Within the Suburban Limits.

The Central Railroad of New Jersey has issued a very interesting pamphlet called "Within the Suburban Limits," made up of about 45 pages. It is beautifully printed and is illustrated with numerous excellent half-tones. Complete information is given about the train service together with the regular single fare, the excursion rate, the family ticket and the monthly individual or commutation ticket. Among others the pleasant and picturesque residential towns which come in for special mention are Greenville, Bayonne, Elizabeth, Roselle, Aldene, Cranford, Garwood, Westfield, with its golf links and its delightful club house. Caldwell in his historic sketch of this section of country says, "Western towns often begin with a saloon—Westfield began with a church, and the history of Westfield is closely allied with the history of her churches."

Fanwood and Scotch Plains are 21¾ miles from New York; Plainfield lies a few miles further on, followed by Dunellen, Lincoln and Bound Brook and Somerville. Diverging from Communipaw the Newark branch runs through Pacific, Arlington, Jackson and West Side avenues. Each is a residential suburb of Jersey City. Newark lies 8½ miles from the metropolis.

In order to reach points on the Perth Amboy branch the main line is left at Elizabethport, a town 17¾ miles from New York, where the large locomotive and car repair shops of the company are situated. On this branch lie Sewaren, Maurer, Perth Amboy and South Amboy on the Arthur Kill, which separates Staten Island from the Jersey shore.

Mr. C. M. Burt, general passenger agent of the Jersey Central, will be happy to send this pamphlet to anyone who applies to him for a copy.

The catalogue of the Walworth Manufacturing Company, of 132 Federal street, Boston, shows the various types of Walworth injectors for locomotive use, in both the lifting and the non-lifting variety. The number of the injector, the sizes of connections, the capacity in gallons per hour, and the price of each is given. Sectional cuts show the parts, which are also numbered and tabulated below for ordering. The Walworth check valves are also illustrated and catalogued. The last few pages describe the Dodge automatic injectors. The Walworth Company also make Stilson pipe wrenches, Hall's brass pipe wrench, Stanwood pipe cutter, the "Ruff and Tuff" dies, pipe taps and reamers, Smith friction drills, "Neverstick" blow-off valves and cast and malleable fittings and brass goods for steam, water, gas and oil. Write them for the catalogue if you are interested.

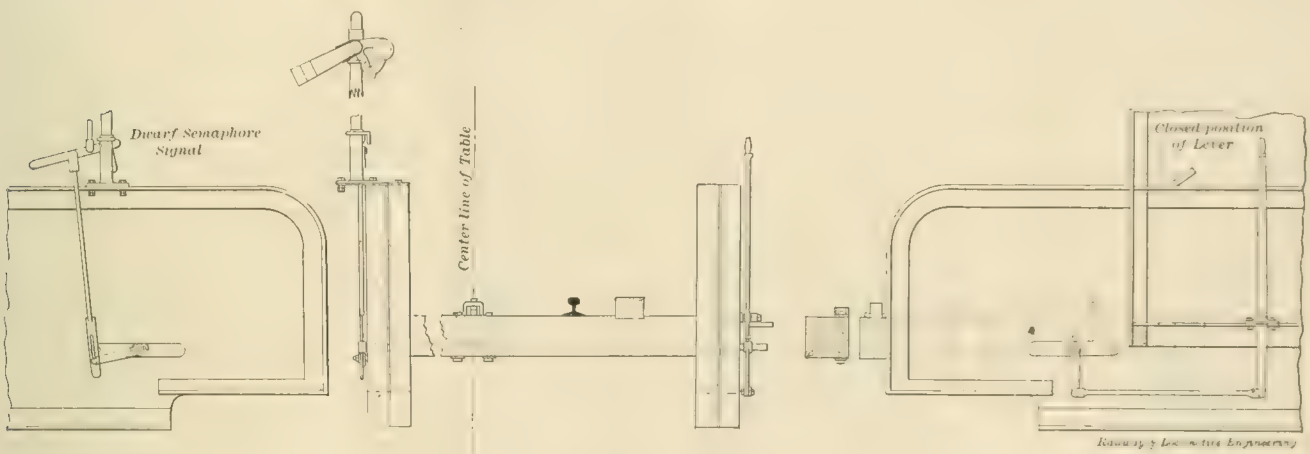
Block Signaling Applied to Turn Tables.

A very clever adaptation of the block signal idea has recently been put into effective operation on the turn table at the Jersey City shops of the Central Railroad of New Jersey, by Mr. Hugh Montgomery, the general foreman.

The table is an electrically operated one and the man who attends to the table has been provided with an apparatus by which, when the table is locked in position opposite any given track, a dwarf semaphore signal will give the "all clear" indication. The act of unlocking the table raises the semaphore arm or shows the danger light. In order that there may be no such thing as the table half unlocked and the warning arm half down, the rod which works between the rotating shaft and the semaphore weight-lever, has a slot in one end, as shown in our illustration, and this provides sufficient lost motion to insure that the bolt be fully three-quarters of the way home, before the signal will "clear," and it will also be part way out of its socket before the signal will begin to move to "danger."

There can be no "permissive" blocking with this table. It is what the boys call a "dead open and shut" and the disregard of this dwarf signal even after the time limit has expired, will mean trouble. Another feature of the device is that the bolt has what might be called a turned-up nose, which enables the bolt to be shot, even when the sag of the table carries the center line of the bolt slightly below that of the socket. This has the peculiarity of restricting somewhat the speed at which the bolt can be moved, because as the table sags more or less at the motor end, even when unloaded, the slightly uphill movement of the bolt into its socket produces a certain amount of friction. The leverage of the system is purposely not made very powerful, so that it is an exceedingly difficult, if not an impossible, task to shoot the bolt when the table is in motion.

The sum total of the device and its operation is that day or night when the signal indicates "clear" an engineer may be sure that the table is fair for his track and that it is locked. The service of one man is all that is necessary to look after the table, as he now automatically signals, as well as places and locks the table, and a reduction of turntable help has been the result. The turntable block signal is a money-saver, it is prompt and it is sure, and it has a penalty up its sleeve all the time for disobedience, like unto that of the open derail.



TURN TABLE BLOCK SIGNAL ON THE C. R. R. OF N. J.

New Sleepers for Canadian Pacific.

The Canadian Pacific officials seem to have a fondness for the letter T. They are building six new sleeping cars which will be named "Thrums," "Thurso," "Trail," "Tyndall," "Trudeau," "Treherne"—names which have a certain significance, and which will be appropriate at once as to geography and human record. These cars will be of the very latest designs. They will be largely patterned after six other sleepers which have just been delivered from Dayton, Ohio, although the local creations will have certain features of originality. Each car will cost about seventeen thousand dollars. They will have every convenience and comfort, ample light, and a nice disposition of space which will give the utmost room.

Round-House Heating and Ventilation.

The 20-stall round-house of the Norfolk & Western Railway, at Portsmouth, Ohio, has been equipped with the "hot-blast" system of heating, the apparatus consisting of a large exhaust fan direct connected to a horizontal engine and drawing air through a steam-coil heater built up of 1-in. steam piping on cast-iron sections. From this apparatus air is distributed throughout the round-house by brick flues and galvanized iron piping, so arranged that heated air may be delivered into each engine pit. The heat so applied will melt off snow or ice from incoming locomotives when that is required. From the pits the heated air rises vertically, so that there is no trouble from smoke or steam in the inhabited zone of the building. On account of the hot, dry air supplied by the system, all moisture due to the melting of snow or ice is quickly evaporated, thus making it possible to work on engines without discomfort within a very short time. During warm weather the fan can be operated without steam in the heater and thus provide very thorough ventilation for the building. Other advantages, as compared with the direct system, are that there is no piping scattered about the building to freeze or burst in cold weather, there are no joints to leak, and there is no danger of fire from the proximity of steam pipes to inflammable materials. Since the piping is all concentrated in a steel-plated housing, where the velocity of the air passing over it is very high, much less length of pipe is needed than would otherwise be necessary. The equipment above described has been designed and installed by the B. F. Sturtevant Co., of Boston.

A series of conferences has taken place between a committee of locomotive firemen on the Erie Railroad and the representatives of the company, resulting in an advance of wages for the firemen in some sections and a general rearrangement of conditions. The conferences were held in this city with Third Vice-President Willard, who has immediate charge of all such matters. Committees representing other branches of the locomotive department have already had conferences with the Erie officials, resulting in a satisfactory agreement being reached. The detailed negotiations were conducted by Mr. W. C. Hayes, assistant superintendent of motive power. Mr. Hayes is an old Brotherhood official, and his skill and experience in settling disputes helped very much in bringing sides to an amicable agreement.

Brotherhood Union Meeting.

A very successful union meeting of railroad brotherhoods was held at Montgomery, Alabama, last month.

On the stage were seated William A. Love, of Atlanta, Ga., a retired locomotive engineer, who acted as master of ceremonies; P. M. Arthur, of Cleveland, Ohio, chief engineer of the Brotherhood of Locomotive Engineers; Deloss Everett, of Cleveland, O., third grand engineer; Timothy Shea, of Peoria, Ill., second vice grand master of the Brotherhood of Locomotive Firemen; L. E. Shepard, of Camden, N. J., junior conductor; Mrs. W. A. Murdock, of Chicago, Ill., grand president of the Grand International Auxiliary of the Brotherhood of Locomotive Engineers.

All these brotherhood officials delivered addresses commending their organizations and the good will of the southern people. In the course of his address, Grand Chief Arthur, of the Brotherhood of Engineers, said he had never ordered a strike in his life, which seemed to excite a great deal of interest not only among his hearers but among newspaper readers all over the country. A number of local statesmen made speeches welcoming the brotherhoods and commending the work they are doing.

Nurnberg Gas Engine.

Mr. A. Rieppel, Koeniglicher Baurat, of Nurnberg, Germany, the managing director of the Augsburg Nurnberg Manufacturing Co., well known for many years as one of the largest and most successful builders of structural iron work, engines, cars, bridges, etc., in Europe, is now visiting this country for the first time. His works employ about 16,000 men, and now have over 2,000 at work on the bridges, etc., of the new railroads being built by Germany in China.

Their latest success has been with gas engines, both for gaseous and liquid fuel. They have long built these engines in smaller units up to 400 H. P., and operated with petroleum, but for the use of waste gas as well as producer gases and in larger units, they have recently developed an entirely new design, constituting the result of many years of extensive experience. The engine which is of the double acting cycle type, generally in tandem arrangement, is best adapted for the various purposes of modern power development up to the largest units required by municipal central stations and iron and steel works.

Mr. Rieppel's visit to this country was made in order to interest the Allis-Chalmers Company in the manufacture of the products of his concern. A contract was entered into by the two companies giving the Allis-Chalmers people the exclusive right to manufacture and sell the Nurnberg gas engine in this country, and selling rights in many foreign countries, especially the far east and in South Africa.

The Augsburg Nurnberg Manufacturing Company, under the direction of Mr. Rieppel, have had phenomenal success with this new gas engine, having within the past few months received orders for some 50,000 h. p. throughout Germany and Spain, chiefly for generating electric energy and for blast furnace and spinning mill work. One of these engines now being built is for an important spinning mill in northern Germany, where the engine will be operated by producer gas.

Mr. Rieppel is now on a tour of inspection throughout the United States, after which he will visit the new and extensive works of the Allis-Chalmers Company at West Allis, where these engines will be built.

New Southern Pacific Shops at Los Angeles.

The Southern Pacific Company are erecting very fine repair shops at Los Angeles, Cal., but the work has been greatly delayed through want of material. We learn from a correspondent that the foundations of concrete for the machine tools, etc., are now well under way. All the foundation piers for the line and counter shafting columns are in also for the 10-ton Niles electric crane over the driving wheel machine tools. The steel roof is now going up on the blacksmith and boiler shops while the one on the machine and erecting shop is nearly completed. The 60 ft. turntable for the roundhouse is being lengthened out to 65 ft. to take the large consolidation engines with semi-cylindrical tanks which were shown in our March issue. The car repair and car paint shops are now well under way and the office and storehouse building practically completed.

The United Engineering and Foundry Co., of Pittsburg, installed last year a complete heating and ventilating equipment in the Roll Shop of the Lincoln Foundry Department. The apparatus, which was furnished by the B. F. Sturtevant Co., consists of a steel-plate exhauster direct-connected to a horizontal side-crank engine. The exhauster draws air from out-of-doors through a large steam heater built up in sections of 1-in. pipe, one of the sections receiving the exhaust from the fan engine.

Copper sheathed passenger cars are gaining popularity very rapidly. Five hundred copper sheathed cars are under construction for the New York Interurban Railway. The plan of using copper sheathing introduced by Mr. Wm. P. Appleyard, of New Haven, are most popular.

Pittsburgh Spring and Steel Company's Works.

On the banks of the Allegheny River, in the city of Pittsburgh, in a region where there are numerous noisy, smoke-emitting factories devoted to turning the products of iron ore into merchantable forms, we find the works of the Pittsburgh Spring & Steel Company, which offer to men familiar with engineering appliances the means of spending an afternoon amid very instructive and entertaining surroundings. These works, illustrated in the annexed engraving, are very large, and are equipped with the very best machinery made for spring making, and they contain many machines and appliances specially made for these works of designs we had never seen before and to be found nowhere else.

The shops are in an enclosure of five acres, which provides ample yard room outside of the buildings. The principal mill is 112x444 feet and another building is 69x287 feet.

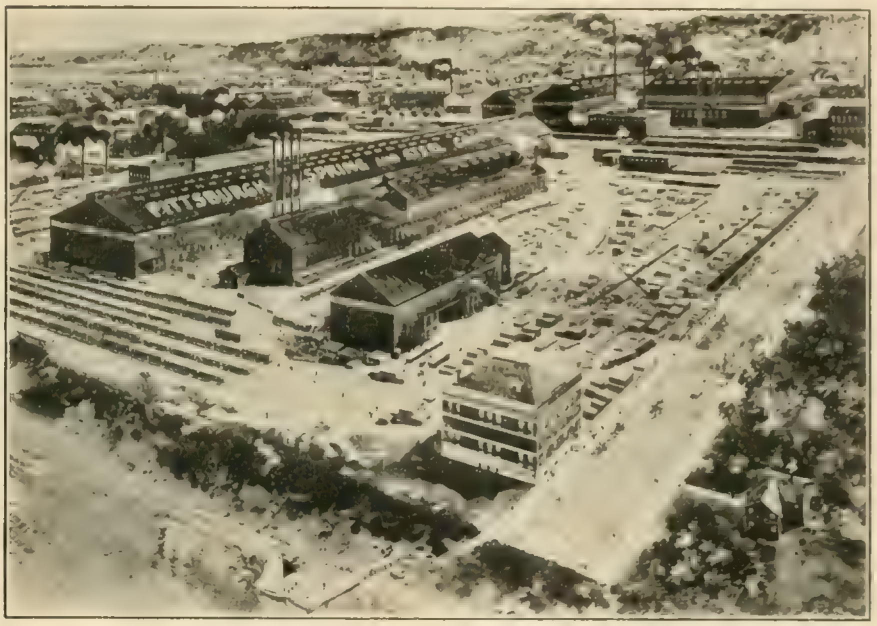
The facilities for conveying material to and from the works are exceptionally good, for on one side there is a line of railroad tracks which serve all railroads, and on the other side there is the Allegheny River, which provides water carriage.

A notable feature about the works is the conveniences provided for the handling of material. There is no double handling of material of any kind where single handling could be arranged. All the steel is brought into the works through the yard in cars to the unloading department. Here, after unloading, the steel is cut into various sizes for use and in due course it is moved along to the machine or furnace where work is to be done upon it. It is always kept moving forward after each operation until as a finished spring, carefully tested, it enters the storage and is ready for shipment.

Facilities are already provided for making and finishing a great output of springs daily and the works can be equipped with appliances that will make it the largest spring establishment in the world.

The heating furnaces use natural gas; but apparatus for making producer gas is also provided. Reversing valves, water cooled, are employed, and the blast is provided by a powerful Sturtevant fan, which maintains air pressure of 8 ounces throughout the establishment. Pure air is provided by a Sturtevant exhaust-fan system.

In moving about the works the visitor is struck the cheerful alacrity with which all operations are conducted. One visitor noticed that many of the workmen's faces were familiar. A little stimulating of the memory and it said you have seen these men during your numerous visits to the A. French Springs Works. Then we reflect that the president of the Pittsburgh Spring & Steel Company used to be the secretary and treasurer of the French Company. That recalls other memories.



PITTSBURGH SPRING AND STEEL WORKS.

Sixty years ago a young blacksmith in Ohio became keenly interested in tempering springs for steel traps that he used as a hunter. He was the kind of youth who struggles for perfection and he learned to forge and temper springs as no blacksmith in the region had succeeded in doing, and his skill made him a prodigy.

Making springs became this blacksmith's hobby. Delving for information on the working of steel was his favorite amusement. In the course of time he became foreman of a railroad blacksmith shop and then put his hobby into practical operation, to the end of making and tempering

springs that were tight and elastic and yet did not break. He became celebrated for the resilience and durability of the springs made under his direction.

After a few years this blacksmith with the spring-making affinities, whose name was Aaron French, became the head of a spring-making establishment, and he turned his skill to making springs on a large scale as they had never been made before. The art which Aaron French devoted to the work of spring making revolutionized the business for railroad rolling stock and made American cars the smoothest riding vehicles in the world. The Aaron French Spring Works maintained their high standard of excellence as long as they were operated.

It looks to us as if the Pittsburgh Spring & Steel Company had donned the Aaron French mantle which the trust rejected.

Pneumatic Tools.

The Chicago Pneumatic Tool Company have issued two special circulars, Nos. 36 and 37. The first is concerned with pneumatic hammers, and gives descriptions and sizes of parts, etc., together with much useful information connected with these hammers. No. 37 deals with pneumatic drills, and is well illustrated throughout with line cuts and half-tones. These circulars will be sent to those who are interested enough to apply. This company is continually on the lookout for new devices which fit in with their line of pneumatic appliances of every description, and have within the past few months made several additions which are the most perfect productions of their kind. Chief among them is a pneumatic hand rock drill, designated as the Chicago Rock Drill, and a compression riveter, which is called the Chicago Compression Riveter. These machines, although but very recently placed on the market, have already indicated, by the heavy sales immediately created, that they are up to the high standard demanded of all tools manufactured by the Chicago Pneumatic Tool Company. Both these machines are illustrated and fully described in attractive circulars which the company is mailing to the trade.

A St. Paul concern has recently devised a very ingenious track gauge indicator which can be applied to the front of a hand car. It consists of two arms which hang down at each side, at the lower ends of which are two rollers which run upon the gauge side of each rail. They are held constantly against the rails by springs and the object of the apparatus is to indicate any spreading or narrowing of the track. The upper ends of the hanging arms are bent over at right angles and are attached to a dial with pointer. As the hand car runs along the track with both rollers touching the rails, the widening or narrowing of the track produces a corresponding motion of the pointer on the dial and thus indicates any variation in track gauge. The apparatus can run over switches and through frogs, in fact, anywhere that wheel flanges will go this indicator can be used.

Metallic Packing.

A small pamphlet has recently been got out by Mr. Charles Longstreath on Metallic Packing and the principles of design for successful development. The pamphlet is a reprint from the *Journal of the American Society of Naval Engineers*, Vol. XV., No. 2. In this paper the whole question of piston-rod packing is considered, and what is requisite and what is not desirable are frankly stated.

The packing, for instance, should allow for vibratory motion. This motion may be caused by the slight difference in diameter between piston and cylinder, as well as by the play between crosshead and guides. It must provide for this vibration and yet be steam-tight without producing excessive friction. On the other hand, packing should not be expected to act partly as a crosshead guide, because this function can only be secured by the sacrifice of the other and essential requisite, viz., the ability to allow for vibration.

There is a great deal of information concerning packing, compressed into the few pages of Mr. Longstreath's paper. The United States Metallic Packing Company, of Philadelphia, will be happy to forward a copy of this pamphlet to those interested enough to apply to them for it.

Four Track Series.

The Four Track Series No. 8, issued by Mr. Geo. H. Daniels, general passenger agent of the New York Central, is concerned with pleasure tours of from two to fifteen days. It contains a very clear colored map of the N. Y. C. lines, and takes in the territory lying between the Atlantic seaboard and the Mississippi river, and from the latitude of Quebec, Canada, down to that of Richmond, Va. All sorts of information is given concerning little tours which may last from Saturday to Monday, or longer if the traveler has the time; the route is given, with time of departure from New York, and the price of the ticket is stated. There is a great deal of useful information about the whole country traversed by this great railway system, which makes pleasant and instructive reading, even if you "can't get away" this year as far as you know yet. The folder will be sent to anyone who applies to Mr. Daniels for it. Address Grand Central Station, New York City.

Broke the Brake.

There was a break in two in Allegheny last month resulting badly for a street car. The brakeman in braking broke the brake, whereupon the car broke loose after breaking through a safety gate, breaking the brakeman's head. The engineer of an advancing train applied the brakes, but could not brake up in time to prevent the breaking of the street car, and it nearly broke the heart of the brakeman's wife, who had just prepared breakfast. The whole thing happened through the brakeman breaking the rules of the company.

The Consolidated "Axle Light" equipments of electric car lighting are steadily coming into general use on the finest cars constituting the best and fastest

PRESIDENT ROOSEVELT'S TRAIN ON THE SOUTHERN PACIFIC.

trains of leading railway lines, including the Pullman cars on all these trains. All private Pullman cars and nearly all the business cars of railway officials, as well as private cars of individuals, are equipped with the Consolidated "Axle Light" system of electric lights. These "Axle Light" equipments are also beginning to be used quite extensively on the railway systems of Great Britain and of Europe.

Mention has been made concerning the rapid strides which have been taken by the Pressed Steel Car Company, of Pittsburg, in the manufacture of pressed steel cars. It is with pleasure that we hear that this company has made and shipped, up to and including May 29, 1903, 100,467 cars; this figure represents the actual number of cars which are in service to-day, manufactured by the Pressed Steel Car Company. It includes steel cars as well as wooden cars, for which steel underframes have been furnished. The company has, for some time past, shipped over 120 cars per day from their McKee's Rocks and Allegheny plants, using in the manufacture of these cars from 45,000 to 50,000 tons of steel plates per month. From the present outlook all previous records which have been established will probably be eclipsed. It is estimated that the output this year will exceed 38,000 finished cars.

A smart hobo was reclining upon a pile of lumber on a warm day watching workmen building an addition to the Schenectady Locomotive Works. Two Poles came along looking for a job, and they mistook the hobo for a foreman in charge of the job. They went up to him and by signs made manifest that they were looking for work. By signs the hobo invited them to a remote point where there was a big heap of sand and some wheelbarrows. By the same token he made them understand that by paying one dollar each they could have a job wheeling that sand to another spot. The money was forthcoming and two hours later a watchman found the Poles energetically moving the sand away from the spot where it was wanted. The tramp did not wait to watch developments. He was evidently a past master of the art of "graft."

John Lambert, of Chicago, seems to think that he owns the earth and the fulness thereof, because he is owner of enough stock in the Steel Trust to be called a "steel magnate." Moved by the fulness of his self-importance, he ordered his private car to be coupled to President Roosevelt's train at Aurora, Ill. The steel magnate was astonished when a switch engine hitched on to it and pitched it ignominiously into a side track.

Western Massachusetts Described by the Boston & Maine.

Western Massachusetts is a section of New England which is noted for its pure air. The country is particularly healthful and invigorating by reason of its high altitude and its delightful situation close to the beautiful Berkshire Hills and the impressive Hoosac Mountains. It is a perfect haven for the worker who seeks health and rest. The natural beauties of this portion of Massachusetts are numerous, and it was here that Hawthorne and Beecher derived inspiration for some of their best writings.

The Boston & Maine Railroad Passenger Department at Boston publishes an interesting booklet of fifty-five pages which gives a detailed and comprehensive description of this region, also a magnificent portfolio of views containing thirty-three perfect photographs of the most beautiful scenes along the Fitchburg Division. The title of the descriptive book is "Hoosac Country and Deerfield Valley," and of the portfolio, "The Charles River to the Hudson." These views comprise also some pictures of that famed historical and scenic country, eastern New York. This portfolio will be mailed upon receipt of six cents in stamps and the descriptive book upon receipt of two cents in stamps or eight cents for both.

The Locomotive Magazine, of London, England, is now a weekly publication. One of its recent issues contains a descriptive article on some new express locomotives of the Great Southern and Western Railway, of Ireland. It also illustrates the portable pneumatic plant used by the same road. This consists of a covered car in which are compactly placed a steam boiler and air compressor from which hose pipes convey air to the various hammers, drills, riveters, etc., which are used in bridge work, boiler and tank repairs at out stations. An early eight-wheel American locomotive, the "Daniel Mason," built for the Boston & Providence Railway in 1858, comes in for mention. A Lancashire and Yorkshire 2-4-0 engine built at Crewe, which for years has worked the fast Blackpool expresses to Manchester and to Yorkshire, is illustrated and there is an interesting description of a run on a French compound, a six-coupled bogie locomotive on the *Chemin de Fer de l'Ouest.* The subject of brick arches in fireboxes is dealt with at some length. Altogether the magazine is a very interesting publication, dealing with British and Continental practice.

The Baldwin Locomotive Works have recently received an order for ten locomotives for Guatemala.

The general management of the Chesapeake & Ohio announces an increase of 10 per cent. in the wages of trainmen and all operating employees of the road. The new order goes into effect at once, and is a welcome surprise to the men affected. It is the policy of this road to have the employees participate in the profits from good business. In the past twelve months its business has earned a handsome profit, and the advance in wages has followed.

Preparing for an Examination.

We were recently asked to answer a series of questions taken from an old examination paper. The questions were not catchy and not particularly difficult. Going over an old examination paper is usually an excellent way of preparing for an examination, but to work away on old examination papers only when getting up a subject is to lean upon, if not a broken, certainly a very weak reed. The right way to get a general knowledge of the subject is to read about it. Your ability to answer ten or a dozen general questions at an examination is not much good by itself, but it is evidence that you possess the general knowledge which is required of you. A man possessing this general knowledge of a subject such as air brake work, locomotive running, railway signaling, etc., etc., is said by his friends to be well "posted." One of the best ways to gain a general knowledge of a subject is to read what has been written about it by men of authority. In the various departments of engineering, as in other departments of human learning, books have been written by experts for the purpose of taking hold of a man who does not know anything of a subject and, beginning at the beginning with him, are able to bring him gradually and easily along. A well "posted" man does not need to fear examinations. Look over the list we present here, and see if there is not at least one book which would be of service to you.

The first on the list is, of course, RAILWAY AND LOCOMOTIVE ENGINEERING, a practical journal of railway motive power and rolling stock. It costs only $2.00 a year, and is well worth the money, and besides the paper is a welcome visitor in every household. Let your wife and boys see it.

"Locomotive Engine Running and Management," by Angus Sinclair, is an old and universal favorite. A well-known general manager remarked in a meeting of railroad men lately, "I attribute much of my success in life to the inspiration of that book. It was my pocket companion for years." We sell it for $2.00.

"Practical Shop Talks." Colvin. This is a very helpful book, combining instruction with amusement. It is a particularly useful book to the young mechanic.

It has a stimulating effect in inducing him to study his business. Price, 50 cents.

"Examination Questions for Promotion." Thompson. This book is used by many master mechanics and traveling engineers in the examination of firemen for promotion and of engineers likely to be hired. It contains in small compass a large amount of information about the locomotive. Convenient pocket size. We cordially recommend this book. The price is 75 cents.

"Compound Locomotives." Colvin. This book instructs a man so that he will understand the construction and operation of a compound locomotive as well as he now understands a simple engine. Tells all about running, about breakdowns and repairs. Convenient pocket size, bound in leather, $1.00.

"Catechism of the Steam Plant." Hemenway. Contains information that will enable a man to take out a license to run a stationary engine. Tells about boilers, heating surface, horse power, condensers, feed water heaters, air pumps, engines, strength of boilers, testing boiler performances, etc., etc. This is only a partial list of its contents. It is in the question and answer style. 128 pages. Pocket size. Price, 50 cents.

"Care and Management of Locomotive Boilers." Raps. This is a book that ought to be in the hands of every person who is in any way interested in keeping boilers in safe working order. Written by a foreman boilermaker. Also contains several chapters on oil-burning locomotives. Price, 50 cents.

"Locomotive Link Motion." Halsey. Any person who gives a little study to this book ceases to find link motion a puzzle. Explains about valves and valve motion in plain language, easily understood. Price, $1.00.

"Machine Shop Arithmetic." Colvin and Cheney. This is a book that no person engaged in mechanical occupations can afford to do without. Enables any workman to figure out all the shop and machine problems which are so puzzling for want of a little knowledge. 50 cents.

"Firing Locomotives." Sinclair. Treats in an easy way the principles of combustion. While treating on the chemistry of heat and combustion is easily understood by every intelligent fireman. The price is 50 cents.

"Air-Brake Catechism." Conger. Nothing better can be found for persons trying to learn all about air brakes. Tells the whole story. We sell it. Cloth, 75 cents. Leather, $1.00.

"Skeevers' Object Lessons." Hill. A collection of the famous object lesson stories which appeared in this paper several years ago. They are interesting, laughable and best of all they are of practical value to-day. $1.00.

"Stories of the Railroad." Hill. Best railroad stories ever written. Those who have not read these stories have missed a great literary treat. $1.50.

"Block and Interlocking Signals." Elliott. Tells what signals are, what they do and how they do it. Comprehensive treatise on the subject. Ought to be studied by all trainmen where block signals are used. $3.00.

"Standard Train Rules." This is the code of Train Rules prepared by the American Railway Association, for the operating of all trains on single or double track. Used by nearly all railroads. Study of this book would prevent many collisions. Price, 50 cents.

"Mechanical Engineers' Pocket Book." Kent. This book contains 1,100 pages 6x3¼ inches of closely-printed minion type, containing mechanical engineering matter. It ought to be in the book case of every engineer who takes an interest in engineering questions. We use it constantly as a reference for questions sent to us to be answered. Full of tables and illustrations. Morocco leather. $5.00.

"Locomotives, Simple, Compound and Electric." Reagan. An excellent book for people interested in any kind of locomotive. It will be found particularly useful to men handling or repairing compound locomotives. It is the real locomotive up to date. $2.50.

Railway and Locomotive Engineering. Bound volumes. $3.00.

The announcement is made that the Allison Manufacturing Company of Philadelphia, will close up their business for good, directly, and that the firm will go out of existence. This is a rather extraordinary decision, for the company has been engaged in the manufacture of cars and boiler tubes for 70 years, and has always prospered. The name alone would be worth a great deal to any concern wishing to carry on the business, but the proprietors do not wish to have the name perpetuated.

The famous old flyer 999 has been making some record runs hauling Uncle Sam's fast mail, on the N. Y. C., but she's been making pretty fast time out of our office lately. We have had to supply this locomotive many times on shorter notice than generally comes to a round-house, but we have always supplied the engine, and on time, too. Look at the reduced reproduction of our chart. It is on page 17, among the advertising cuts. The chart gives the names of all the parts of a standard engine and in fact is an illustrated index.

The J. A. Fay & Egan Company, manufacturers of woodworking machinery, have notified us that they have a neat little watch charm which they will send free to any person who will write them for one. Their address is 445 West Front street, Cincinnati, Ohio.

A Train for Hauling Water.

The Union Pacific Railway has lately had a train built which is the first of its kind in the world. It will be used to convey water to the various water stations in the West, where the local supply is strongly impregnated with alkali, which is very bad for the boilers. The cars are of pressed steel, covered with planks, and fitted with the necessary valves. The experiment has been very successful.—New York *Commercial Advertiser*.

A new corporation is the Gould Coupler Company, of Depew, Erie County, to manufacture and deal in car couplers, and the business now carried on by the Gould Coupler Company, of West Virginia; capital, $5,000,000; directors, Charles A. Gould and Frederick P. Huntley, of New York city. The Gould Storage Battery Company, organized with a capital of $5,000,000, also filed papers.

In the Corporation Museum, Leicester, there is a most interesting collection of railway relics presented by Mr. C. E. Stretton, the well-known engineer and writer on railway historical subjects. In the collection is a pair of wheels from the Duke of Rutland's Railway at Belvoir Castle, which are grooved by wear nearly half an inch deep. Some of the rails on which these wheels ran from 1793, over 109 years, are shown. The rails weigh about 40 pounds to the yard which was a great weight for the time the rails were made.

The business of the Pressed Steel Car Company so far this current fiscal year shows an increase in gross receipts of about 26 per cent. over the same period in 1902. There has of course been an increase in expenses as the result of higher prices for materials and labor, but the financial results obtained since January 1, when the company's fiscal year began, are regarded by the management as highly satisfactory.

Among the improvements being made by the Chicago & Northwestern Railway is the introduction of new turntables, 70 feet long. The modern locomotive has outgrown the capacity of the old turn-tables, and not a few railroad companies are embarrassed to turn the locomotives that have lately been brought into service.

There has been some talk of a strike in the Wabash Car Shops at Decatur, Ill., because J. M. Lichdenberger, the head of the Carmen's Union, refused to go to St. Louis to fill a different position. An attempt was made to convert it into a case of persecution of labor leaders but it did not succeed very well.

The British Westinghouse Company has been awarded a contract by the London city council that calls for the equipment of 200 electric cars. The contract amounts to $70,000 and is the largest contract for equipping such cars that has ever been let in England. One half of the cars will be of the single-truck type and the remaining number will be double-deck, double-truck tram cars.

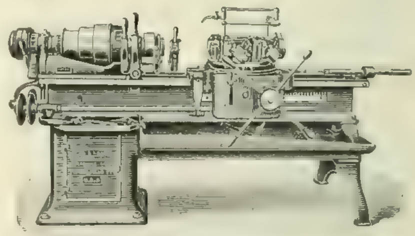
Those who usually ride on street cars would hardly desire to spend the night upon them, but we notice that in several parts of Ohio they are placing sleeping cars on street railways. A sleeping car service has been introduced between Cincinnati and Columbus, and we believe that one will also be established between Cleveland and Toledo. The speed of these cars is not very rapid and they run over very smooth tracks, so that persons going from one city to another may spend the night very comfortably in the interurban sleeping cars.

The Morton Trust Company, and the Pressed Steel Car Company have filed another bill in equity against the Standard Steel Car Company in the United States Circuit Court. The new case alleges infringement on the part of the defendant company of a patent for a "combined stake and pocket for cars." An injunction restraining the defendant from further manufacture of the device and damages are asked.

Several years ago the Rome Locomotive Works were purchased by the Compressed Air Co., to be used for building compressed air motors. That business did not flourish and lately three creditors filed a suit against the company. The aggregate of the claims are $3,205, and they are based on overdue orders, partly secured by bonding of the locomotive company. The company's creditors allege that the Compressed Air Company, although insolvent, preferred certain creditors by paying them $7,425 interest on bonds.

Some powerful passenger locomotives built by the Baldwin Locomotive works, in Philadelphia, will be added soon to the equipment of the Long Island Railroad. There are eight new ten-wheelers of the most powerful type, to be used on the Montauk and main line and the north side branches, besides new freight and switch engines.

The gross earnings of the Chicago Great Western Railway (Maple Leaf Route) for the month of May, 1903, show an increase of $76,689.49 over the corresponding month of last year; being an increase for the fiscal year of $142,908.17.



Great Guide Wheel Railway.

In my younger days I used to read a great deal in the *Illustrated London News* about the Great "Guide Wheel" Railway, that was going to revolutionize railroading in England. I remember there was a bracket in front of the engine, that carried a double flange wheel in contact with a third or middle rail. Who can tell the readers of RAILWAY AND LOCOMOTIVE ENGINEERING all about it?

W. DE SANNO.

San Francisco, Cal.

The Chicago Pneumatic Tool Company have recently issued a couple of special circulars, Nos. 38 and 39, which illustrate their various types of pneumatic appliances.

Circular No. 38 shows the method of cleaning crownsheets, when a locomotive is in the shop for general repairs. To do this work a jam riveter is used and the method of operation is very clearly shown in the cut which appears on the second page of the circular. Tube expanding is also done with a jam riveter, and the way this is accomplished is duly set forth and illustrated. The Boyer drill, with yoke attachment, which is shown, makes it possible to drill in any position and in exact center. The machine being hung by a bale, enables the operator to turn it in any desired direction. Several other well known specialties made by this concern are also illustrated.

Circular No. 39 gives illustrations of the various tools at work. The photographs from which the half-tones are prepared having been taken from actual scenes on bridge or building work.

The Chicago Pneumatic Tool Company will be happy to send these circulars to any one who writes them for copies.

The Covington, Kentucky, City Council have passed an ordinance prohibiting the use of soft coal by railroad companies while running trains through the city limits. If hard coal turns out to be as scarce next winter as it was last winter compliance with the city ordinance would mean the stopping of the trains altogether.

The Nernst Lamp Company, of Pittsburgh, Penna., has established a Maintenance Bureau for the purpose of supplying users of Nernst lamps with new burners or holders, so it will not be necessary for the customer to visit or call upon the electric light stations when one of his lamps gives out.

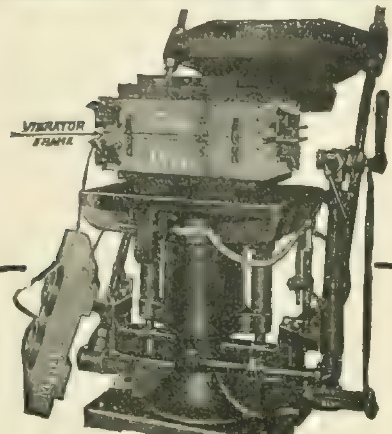
To meet the demands for additional accommodations on the southwest system of the Pennsylvania lines, 55 cars, now in process of building, will be added. They include coaches, baggage and mail cars. At the Columbus shops the cars under construction are: Three 70-foot combination coach and baggage equipped with electric lights; five 70-foot baggage, mail and express cars, one postal and three 60-foot horse express cars. At the Altoona shops there are 21 vestibuled passenger coaches and nine 60-foot baggage and express cars being built. In the Allegheny shops there are eight baggage and express cars under construction.

American threshers, reapers, binders and mowers have a monopoly of this trade, and are being used more and more each day in France. As for locomotives the French railway companies have found them satisfactory and as economical when given all the work they can do as the French engines. They insisted that American manufacturers should fashion their products so as to agree with the requirements of the French law. In many instances the American locomotives had to be changed and often a redistribution of weight on the rails was necessary. The grates have to be changed also so as to burn the coal in use upon that particular railway system. These changes made after the arrival of the locomotives, the consul says, could be obviated by study on the part of the manufacturer.

Modern express engines are capable of attaining great speed, but it is doubtful if any advance in speed has been made since the first decade of the railroad era. Seventy miles an hour was frequently made by British express engines before 1840. A Crampton engine built by Norris at Schenectady in 1849, with one pair of seven foot drivers, had an authenticated record of 76 miles an hour hauling eight passenger cars. The difficulty with the early fast locomotives was that they were short of heating surface and therefore of steam making capacity. They could not maintain fast speed.

When railroad companies first began to run locomotives without wiping, their critics said that the engines were generally run at night because the officials were ashamed to see the masses of dirt moving through the country in daylight. The practice of running engines that are never wiped is now so common that people do not think anything about the appearance, but we always thought it was an expensive method of cutting down expenses.

The small locomotives recently used on the elevated railroads in New York, and discarded on account of the adoption of electricity, are finding their way to all parts of the world. Many of them are in use on plantations in Cuba, Porto Rico and Mexico, and recently two were shipped to China to be used in construction work on the railroad between Canton and Hankow.



CONTENTS.

Car Axle Electric Lighting.

The New York Central Railroad has made successful experiments with the new system of illuminating cars with electric light from power generated by the revolutions of the axles of the wheels controlled by the Consolidated Railway Electric Lighting and Equipment Company.

Electric lights have been used on the limited trains for a long time, the power being furnished by a dynamo in the baggage car, which required the attention of a man who did nothing else.

The new system has proved a success, and it is understood that it will be extended to the coaches as fast as possible. In fact, several of them are already equipped, affordng a good light.

One of these cars is run every night on the Montreal special. Last evening a still further innovation was installed in the form of electric fans, one of which was in motion at either end of the car.

The General Electric Company are experimenting with electric motors as a substitute for the festive mule in hauling the canal boats that drag their weary way over the peaceful waters of the Erie Canal. The politicians of New York State are giving the electricity project less than lukewarm support. They are apprehensive that accelerating the movement of canal boats may restrict the enormous quarry for stealings that the canal has been these many years. They don't intend to permit anything to interfere with the latest huge graft if they can help it.

The Steam Shovel and the Steam Navvy.

The American type of shovel differs from the British navvy, in that it is part of the standard rolling stock and can be coupled in a train for transportation, whereas the British machine is usually mounted on four rigid wheels. In addition to convenience for transportation the double trucks of the American machine have the advantage of greater flexibility and distribution of load on soft or uneven ground and allow it to work more readily on curves. The American shovel has powerful independent engines for swinging the boom and feeding the dipper, and its movements are very fast.

The French and German types of endless chain machines are heavier and more cumbersome; they cannot adapt themselves to a wide range of conditions, they require a well laid, straight, level track of five rails to work on, and they are adapted to load only small cars that will go through the tunnel of the machine. They are inferior to the American type in point of ability to deal with obstructions such as bowlders and stumps and to work in rough and irregular ground, and the wear and tear of a chain of buckets and links is very great.—A. W. Robinson, in the *Engineering Magazine.*

CONTENTS.

INDEX TO ADVERTISEMENTS.

Railway and Locomotive Engineering

A Practical Journal of Railway Motive Power and Rolling Stock

Vol. XVI. 174 Broadway, New York, August, 1903 No. 8

Baldwin Passenger Oil Burner for the Southern Pacific.

In our issue of last April we were able to give some details concerning an oil burning Vauclain compound consolida tion for the Southern Pacific. We are now able to reproduce a 4-4-2 Vauclain compound oil burner for the same road built at the Baldwin Locomotive Works at Philadelphia.

This engine is interesting in several particulars. The cylinders are 15 and 25 ins., and the stroke is 28 ins. The driving wheels measure 79 ins. outside tires, and the main driver is forward. The total weight of the engine is about 200,000 lbs., of which about 102,190 lbs. are borne by the drivers. The pressure carried is 200 lbs., and this with other data gives a calculated tractive effort of about 21,700 lbs. The piston valve gear is driven by indirect motion in the usual way. The diameter of the carrying wheels is 54¼ ins., and they and the driving wheels are equalized together.

The boiler is of the extended wagon type and is 66 ins. at the smokebox end. The dome course is 82 ins., and the circular back head is 76 ins. The boiler is supplied with a Vanderbilt corrugated firebox arranged for burning oil. There are 346 tubes, each 16 feet long. The total heating surface is 3,038 sq. ft. The furnace is 63 ins. diameter by 117½ ins. long, and has an ordinary fire door. Below the fire door is small circular opening for the oil injector.

The tender is of the semi-circular section adopted for oil burners by the Southern Pacific and it is carried on a steel channel frame. The tank contains two compartments, the one next the engine holds 3,300 gallons of oil, and the one at the rear can contain 7,300 gallons of water. There is a running board and hand rail along the side of the novel tank. The tender is standard and is used with passenger or freight engines with equal facility.

The engine has a driving wheel base of 6 ft. 10 ins., and a rigid wheel base of 15 ft. and the wheel base of the whole engine is 31 ft. 3½ ins. and the total of engine and tender amounts to 65 ft. 5½ ins. The weight of the entire machine, engine and tender—taken together is about 340,000 lbs. The absence of any grate or ash pan gives this engine a clearcut appearance at the back and the general design suggests a "high-stepper." The cab is made of steel plate and the window arrangement looks as if the comfort for the engineer had been taken into consideration.

A few of the principal dimensions are appended for reference:

Boiler, type, ex. wagon top; dia., 66 in.; thickness of sheets, 11/16 in. and [illegible] in.; working pressure, 200 lbs.; fuel, oil.

Firebox, Vanderbilt corrugated; thickness of tube sheet, ½ in.; tubes, material, steel; wire gauge, .125 M. M.; No. 346; dia., 2 in.; length, 16 ft.

Heating surface, firebox, 155.0 sq. ft.; tubes, 2,883 sq. ft.; total, [illegible] sq. ft.

Driving wheels, dia. outside, 79 in.; journals [illegible] x 12 in.; engine truck wheels, front, dia., [illegible] in.

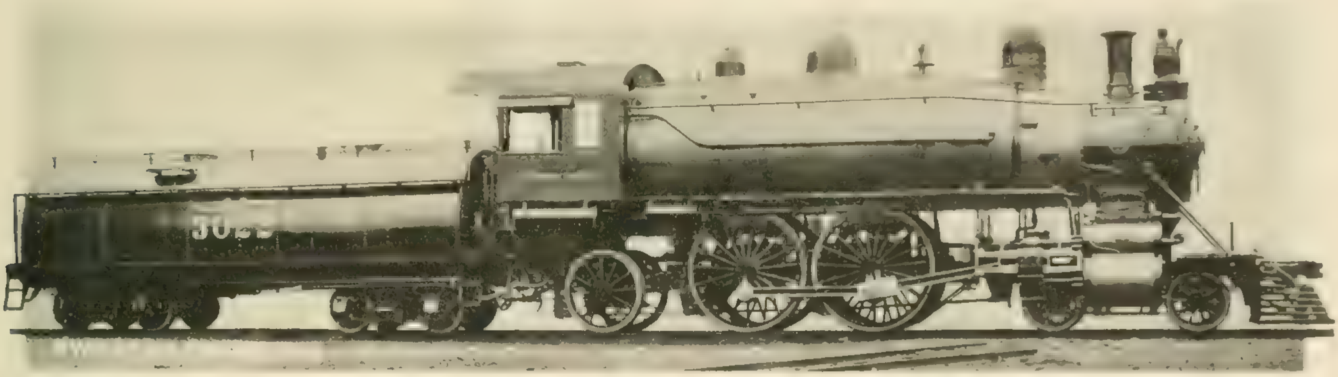
Journals, 6 x 10 in.; carrying wheels, dia., 54¼ in.

Journals, 8½ x 12 in.; wheel base, driving [illegible] ft. [illegible] in.; rigid, 15 ft.; total engine, 31 ft. 3½ in.; total engine and tender, 65 ft. 5½ in.

Weight on driving wheels, [illegible] lbs.; total engine, 200,000 lbs.; total engine and tender, about [illegible],000 lbs.

Tank capacity, water, 7,300 gal.; oil, 3,300 gal.

Tender wheels, dia., [illegible] in.; journals, 5½ x 10 in.



ATLANTIC TYPE. OIL BURNING COMPOUND FOR THE SOUTHERN PACIFIC

Railroad Equipment.

The following facts and figures were gleaned from the Interstate Commerce Commission's recent report:

On June 30, 1902, there were 41,228 locomotives in the service of the railways, which was 1,644 more than were in use in 1901. Of the total number of locomotives, 10,318 are classed as passenger locomotives, 23,594 as freight locomotives, 6,683 as switching locomotives, the remainder, 633, not being classified.

The total number of cars of all classes in the service of the railways on the same date was 1,640,220, there having been an increase of 89,387 in rolling stock of this class. Of the total number of cars, 36,991 are assigned to the passenger service, 1,546,132 to the freight service, and 57,097 to the direct service of the railways. The foregoing figures do not include cars owned by private companies.

The report shows that the railways of the United States used on an average 206 locomotives and 8,195 cars per 1,000 miles of line, that 62,985 passengers were carried, and 1,908,310 passenger miles accomplished per passenger locomotive, and that 50,874 tons of freight were carried, and 6,666,499 ton miles accomplished per freight locomotive. Embracing in the term "equipment" both locomotives and cars, it is noted that the total equipment of railways at the end of the year

was 1,681,448. Of this number, 1,306,849 were fitted with train brakes, the increase in this item being 142,801, and 1,648,535 were fitted with automatic couplers, the increase being 98,695. Nearly all locomotives and cars in the passenger service were fitted with train brakes, and of 10,318 locomotives assigned to that service 9,462 were fitted with automatic couplers. Practically all passenger cars were fitted with automatic couplers. Regarding freight equipment, it is observed that nearly all freight locomotives were equipped with train brakes and 94 per cent. of them with automatic couplers. Of 1,546,132 cars in the freight service, 1,204,929 were fitted with train brakes and 1,520,997 with automatic couplers.

Training an Artist in the Forces of Nature.*

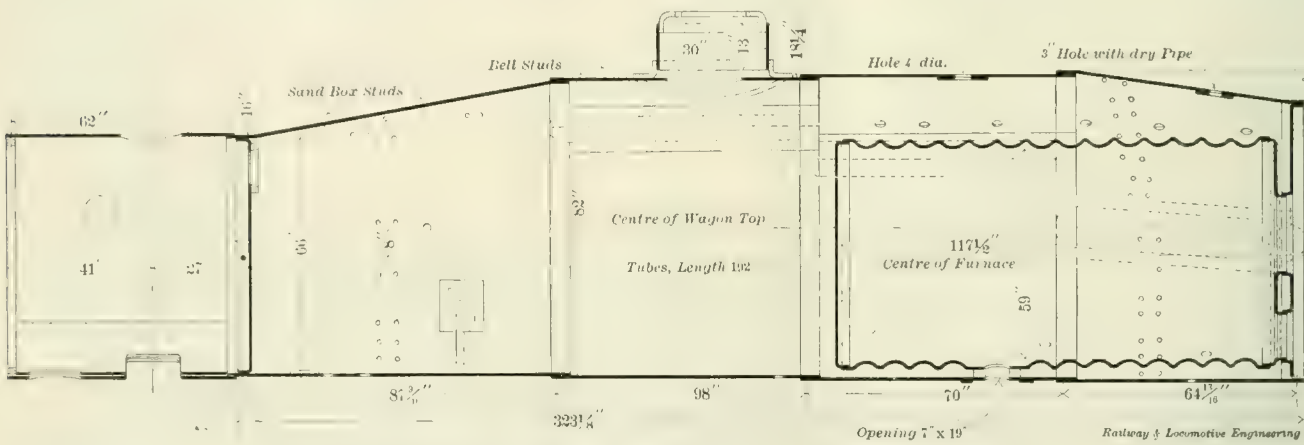
BY E. H. MULLIN.

If we go back in the history of our language to the first known use of the word "education," we find that in 1540 it had as its meaning "the process of nourishing or rearing a child or young person." It will be noticed that in this case, as in so many others, a term which may now be regarded as meaning something abstract and psychological is derived by metaphorical extension from an earlier concrete and physical concept. Yet if the word "education" has gained in breadth since its first use four and a half centuries ago, it has also lost much in depth—at least as commonly used. The essence of the word "nourishing" is assimilation; it conveys the idea of the food which is most easily converted into life-giving blood, and thence, with hardly a pause, into nerves, bones and muscles, to become an inseparable part of our bodies. For one reason or another, we seem to have passed beyond the stage of a simple educational diet which can be thoroughly assimilated; we present either the jaded palates of a worn-out race, or the capricious appetites of spoiled children. Instead of the educational roast and boiled joints of our forefathers, we toy with highly seasoned *entrées* which blunt our appetites for the time being, but do not give us the strength for long fasts, the energy for great work, or the physical repose necessary for deep thought.

We shall find, if we keep the idea of assimilation as the primary attribute of all education, that the physical and mental analogies are reasonably close and hardly, if at all, misleading. Mental indigestion from over-stuffing, no less than physical indigestion, produces cloudiness of the brain. Mental dyspepsia may follow a diet of too large a variety of elective courses, just as physical dyspepsia may follow over-indulgence in highly spiced but non-assimilative foods. In both cases time is an indispensable factor to assimilation; plain food will be most enduring in results; maximum efficiency will be found in maximum assimilation and minimum waste. Fixed habits are perhaps the most valuable gift we can receive, whether from home rearing, from college training, or from that first part of our lives passed in the world of men. Yet granted that we have taken a firm hold of essentials, we may pursue cognate non-essentials as an enlightening means of recreation. Every author has his historical background; every science has its borderland; every art has its path of development. Knowledge is the result of profound study; culture is the reward of diligent exploration. With knowledge alone we are as flatlanders, realizing our neighbors only when we touch them; by the aid of culture we can rise above our surroundings, and, by viewing the relation of our neighbors to each other, form a juster estimate of our relation to them.

For, in our realization of our true relationship to the whole of the outer world lies the benefit of our education. The pure specialist, without sympathy and without comprehension, is simply a machine tool in the hands of a higher order of intelligence. When Mr. Carnegie claimed for himself only the power of acting as a magnet for much abler men, he either meant much more than he said, or said much more than he meant. To utilize ability, to turn it into its proper channels, to mark the time and place when and where one kind of specialized mind should begin and where it should stop to allow the next specialized mind to take up the running, is the function of true greatness. The general in command of armies, the statesman responsible for a party, the captain of industry with success or failure hanging upon his decision, asks no more than that the subordinate whom he chooses can convert his ideas into action. "Be bold, be bold, be not too bold," said the ancient sage. "Specialize, specialize, but don't specialize too much," says his modern analogue.

Capital, modern economists are agreed, is the crystallized savings which can be lent out to reproduce itself in useful work. It is, in fact, stored energy. In its baldest form, capital represents the wheat saved from last year's crop to enable the laborer to garner next year's crop without dying of starvation while next year's crop is growing. In its broadest sense, education is not capital but tools. It is not the knowledge of facts which makes a man educated, but the possession of method. To teach a man to learn how to learn is the true function of education, and to stuff his mind with facts beyond this point is merely to encumber him in pursuing his means of livelihood. It is true that the method of education adopted may, and perhaps should, bear some relation to ultimate ends. The future classical scholar will save himself much annoyance by a diligent study of Greek irregular verbs. The future mechanical or electrical engineer will enjoy an ease, not otherwise procurable, by a thorough mastery of elementary mathematics.



BOILER OF SOUTHERN PACIFIC ENGINE WITH VANDERBILT FIREBOX

* This paper was read at the Convention of the Institute of Electrical Engineers, held at Niagara Falls in June. Mr. Mullin is an official of the General Electric Company.

But, still, education is not so much intended for the elucidation of old problems as for the tackling of those that are new. And, as a knowledge of facts without the power of ratiocination is worthless for new ventures, and as every problem which meets us in life is a new venture, therefore, method by itself is everything, and facts by themselves are nothing.

The faults of technical education of the present day are that they tend to reproduce a microcosm of real life. Everyone has heard of, or has seen, a typical specimen of the "tank drama," in which there is real water, real horses, a real fire engine, or what not, to heighten the verisimilitude. The technical colleges which attempt to make a blacksmith or a mechanic out of a student, fail, just as the "tank dramas" do, by endeavoring to make their courses a miniature copy of future work instead of making them typical of crisis and illustrative of principles. Let us glance for a moment at the two great professions where education, as commonly understood, utterly fails to supply a man with the power of commanding success. It will be acknowledged that painting is an art which requires initiation and instruction. Yet, without genius, without inspiration, even the most skilful painters have been unable to rise above the ranks of mediocrity. The Italians call Andrea del Sarto "the faultless painter." But, as Symonds says, he lacked inspiration, depth of emotion, energy of thought, and cannot therefore take rank among the great Renaissance painters. Or take again the two typical cases of the Archduke Charles and Major General Halleck, for both of whom it may be claimed they were bright and shining examples of profound technical education in the military art. The genius of Napoleon, not a particularly distinguished student, overthrew with ease the strategy of the Archduke Charles, while all that Halleck's technical knowledge seemed to be able to do for him was to point out every possibility of defeat without inspiring him to a single means of victory. More recently we have seen Sir John French, the only really successful cavalry general of the South African War, overthrow in the field the reputation which the pedants of Aldershot gave him of not being able to handle a cavalry brigade.

We may gather from these examples, and from others which will occur to the minds of every one, that all that technical education can do is to give each man his chance of success or failure. Genius may be able to dispense altogether with technical education; inherent stupidity will ultimately sink to its true level, in spite of the most careful collegiate training. In considering educational matters, therefore, we are concerned not with geniuses or with muddle heads, but with average men. How the average man may be trained for a profession for which he feels within himself some aptitude is the question which it behooves us to answer. And the answer which we should give is to teach methods, to instill principles, to lay deep and sure the foundation of elementary knowledge, and trust the future to take care of itself. We have, therefore, two co-related branches of education to consider—education as an art and education as a science.

Education as an art involves perfect familiarity with a larger or smaller number of facts, according to the purpose to which these are to be devoted. In this age of universal reading and writing we are apt somewhat too hastily to assume that a categorical knowledge of the alphabet and the arithmetical tables is necessary to success in life. Those who have lived in countries where a considerable portion of the population is wholly illiterate must have often been struck by hearing men who could not read use language all but grammatically correct, or by observing intricate accounts made up by mental arithmetic without the aid of either multiplication or division. It must also be remembered that in the Dark Ages kings and bards were usually illiterate, though they were none the less the rulers and inspirers of their times. Education as an art, therefore, must be separated from personality on the one hand and from mere pedantry on the other. We may compare education as an art to a knowledge of the names and functions of the pieces on a chessboard divorced from any knowledge of the game of chess itself. If we can then imagine a series of chessboards, each having more pieces than the one preceding it, and each set of pieces having more complex moves than the set preceding it, we shall have a fair analogy of the gamut of education as an art, from simple elementary education to the highest classical or mathematical standard. Throughout this series there are things to be known by name—what may be called primary concepts—and these mere names have to be clothed with ideas or attributes or functions, by means of which we may see how far we can utilize them. In other words, in education as an art we have to exercise the faculty of memory, and this memory must be clear and accurate if our minds are always to have their tools at hand ready for instant use. But this in turn implies familiarity and familiarity implies constant practice for a longer or shorter time. Here again our average education for the average man comes in. If we have in mind only the first 25 per cent. of our pupils—the geniuses and the hard-reading men—we shall pass along to the next stage before our 50 per cent. of average men have had time to become perfectly familiar with the facts and their connotations which are being studied. If, on the other hand, we attempt to wait until the last 25 per cent. of our pupils—the incorrigibly idle and muddle-heads—we shall waste the time of our 50 per cent. of average men. In every stage of education as an art we have therefore two things to consider, namely, the accumulation of a sufficient number of names and their connotations to give us an ample nomenclature or set of tools, and also enough familiarity with this nomenclature or set

A SOUTHERN PIONEER. RECEIVED FROM T. KEPLER JOHNSON, CONTRACTING FREIGHT AGENT OF THE ILLINOIS CENTRAL, WHO PHOTOGRAPHED THE ENGINE AT JACKSONVILLE, FLA.

of tools to enable us instinctively to select the right tool and to use it efficiently.

Let us now pass to education as a science. A man might know the dictionary from end to end, and yet not be able to use more than one thousand words of it for any particular purpose. Having obtained our tools through education as an art, the problem in education as a science is not to use them as we have been taught but to apply them to new problems. To go back to our former illustration we must be able to play the game of chess after having learned the names of the pieces and their functions. It took the world 2,000 years to find out that deductive logic could state nothing new beyond what was contained in the premises. Science, we are told, is organized and classified knowledge, and the first thing a truly educated man will do with a new fact is to place it under its proper classification—that is, he will refer it to the principle which governs facts of a similar kind. Not only, therefore, is memory needed here but imagination. A man's whole education goes for nothing if in dealing with a new fact he cannot see resemblances in it to other facts where none outwardly exist, or cannot see profound differences between a new fact and an old one where the outward resemblance is strong. And the highest function of education as a science is to make a man of average ability see resemblances and differences in cases where he would otherwise be blind. Indeed, genius itself, as we see it in the great inventors, is usually nothing more than the power of classifying a fact under its proper generalization and then re-stating it in terms of some other fact classed under the same head.

Rising stage by stage, therefore, according to the future for which our educational requirements are to fit us is our elementary knowledge plus perfect familiarity in dealing with and handling it. Better, far better, that we should know little but be on terms of perfect familiarity with that little, than we should know much and have to grope for what should spring to our minds as quick as thought itself. The time spent, the labor involved, in obtaining an absolute mastery over our primary concepts or elementary knowledge marks the difference in our future work between having strange tools to handle and having tools which so fit into our hands as to become an inseparable part of ourselves.

Let us turn now to the education of an engineer. The definition of an engineer, according to Brunel, is one who applies the forces of nature to the service of man. Mr. Mansergh, recently President of the Institution of Civil Engineers, quoted with approval an American definition of an engineer as "a man who could do for one dollar what any fool could do for two dollars." Perhaps the best definition will lie somewhere between these extremes. If a man does not know how to apply at least one form of the forces of nature to the service of man he is not an engineer; and if he cannot do this more economically than an outsider no capitalist with common sense will employ him. An engineer differs from a physician or a lawyer in that patients die and cases are lost without damaging the reputation of a member of either of these professions, while, on the other hand, an engineer's work must speak for itself. The motto over Sir Christopher Wren's tomb in St. Paul's might be adopted as that of the engineering profession as a whole, "*Si monumentum requiris circumspice.*" Posterity camps on the trail of the engineer, and its conclusions, like the judgments of the Lord, are true and righteous altogether. Whether it be the aqueduct of Rome or the Brooklyn Bridge, whether it be a generator at Niagara Falls or the switchboard of a New York power station, it will either form a model from which other generations of engineers will expand into new conceptions to meet new needs, or it will become a beacon post to point out the way which is to be avoided. Verily, it is no light thing to train up an artist in the forces of Nature!

Let us begin with the prime essential. Without reverence for great works and for the great men by whose agency they were brought forth, there will be no great engineers. Granted that, a sound knowledge of one's native tongue is the best substructure. The great engineers who have been deprived of this aid, have borne eloquent testimony by their efforts at self-improvement in later life to what they considered would have been its usefulness at an earlier period of their careers. An elementary knowledge of Latin is most indispensable to the clarification and consolidation of the knowledge of nearly every European tongue. Next to these my vote would go to a good working knowledge of French because besides its obvious advantage as a language to be spoken, it imparts lucidity and precision to writing—a thing, by the way, which mathematics often fails to do. Early practice in mechanical drawing should also be given to every boy who feels within himself the stirrings to become an engineer, because familiarity with the pencil is easily acquired early in life, but is often one of the greatest stumbling blocks when taken up too late.

Then as to mathematics. As the profession of an engineer always involves constant dealing with quantities and values, he ought to know mathematics as he knows the currency of his native country. In other words, he ought to be able to make change with ease, quickness and accuracy—not as if one were in a foreign country in a constant state of painful reckoning. A thorough knowledge of ordinary mathematics is here prescribed, not any vain ascents with crippled wings into the empyrean. What is meant by "ordinary mathematics" may perhaps be more clearly indicated by a remark and an anecdote. One may make accurate change without any knowledge of the science of numbers. Lord Salisbury, when President of the British Association, told the story of the old Oxford Professor who said to him, fiercely, "What I like about quartenions, Sir, is that they cannot be used for any base utilitarian purpose."

This makes our substructure complete. The first part of our superstructure should consist in learning the principles of the applied sciences. These should be studied in books, assisted by oral teaching, and enforced and re-enforced by the practice of dozens or hundreds of examples. If one wants to know how each principle should be learned, he should watch a great singing teacher train a pupil. A false note in a scale demands a hundred perfect repetitions. A false note in an *aria* means back to the scale for a hundred more repetitions before attacking the *aria* a second time. Why should the future artist in Nature be less carefully prepared for his work? Is that work likely to be less important? or is it merely because his future audience is less likely to detect a false note?

With this, the education, of our engineer ends or rather begins. He may be fifteen, sixteen or any age. He may have studied in school, or in college, or at home. He is, however, a trained engineering soul, according to the measure of his talents. He is able to learn the art of engineering, or any other art, for which he has an aptitude, in months, where another man of equal ability might take years and not know it half so thoroughly. All he needs to ensure his success in life is to find a master who can utilize his powers.

The Baldwin Record of Recent Construction, No. 43, has just come to hand. It contains many interesting locomotives, among which may be mentioned two ten-wheel engines for the St. Louis & San Francisco, with wheels counter-balanced after the Davis method. A Mikado or 2-8-2 engine for the Atchison, Topeka & Santa Fe. A compound consolidation with tank for oil and water for the Southern Pacific. This engine has a tank which is semi-circular in section, it was illustrated in our April issue. A compound ten-wheel engine with Vanderbilt tender and a compound consolidation with Vanderbilt tender for the Oregon short line. A simple consolidation for the Ferro Carrill Nacional de Tehuantepec, and several others.

Consolidation Engine for the Illinois Central.

The Schenectady shops of the American Locomotive Company have recently supplied the Illinois Central with some 2-8-0 engines which weigh in working order about 188,000 pounds. The cylinders are simple 20x28 ins. and the driving wheels are 56½ ins. With 200 pounds steam pressure, the engine can develop a calculated tractive power of about 26,350 pounds. The adhesive weight is estimated at 163,000 pounds.

These engines have all the wheels flanged except the main drivers, and with long connecting rod the counterbalancing on this pair of wheels is necessarily heavy. The crosshead is made for two guide bars with the upper bar lipped so as to cover top of crosshead and keep bar and cross head side flush. The valve gear is of the regular indirect connected type and the valves themselves are the ordinary D-slide, balanced. The engine truck and front driver are equalized together, and the three rear drivers are equalized together. There are also two main reservoirs for air.

The boiler is an extension wagon-top one, with smokebox course measuring 66 in. inside diameter. The dome is circular, but the opening cut through the boiler course upon which it rests is oval, with center placed one inch forward of the dome center. The heating surface amounts to 2,709.4 sq. ft., of which the tubes supply 2,539.3 sq. ft. The crown sheet slopes slightly toward the back, and the roof sheet slopes 6 inches toward the back sheet, which is vertical. The grate area is 54 sq. ft.

The tank is carried on a 12-in. steel channel frame, and with its water bottom can contain 7,000 gallons. The coal space is made with sloping sides and a bulkhead front, so that 15 tons may be carried. A few of the leading dimensions are given below:

Wght. eng. and tend. in working order, 332,450 lbs.
Wheel base, driv., 16 ft.; wheel base, tot., 24 ft. 8 in.
wheel base, tot., eng. and tend., 57 ft. 4½ in.
Cylinders—20 x 28 in.; size of steam ports, 20 x 1½ in.; size of exhaust ports, 20 x [illegible] in.; size of bridges, 1½ in.
Valves—Greatest travel of slide valves, 6 in.; outside lap of slide valves, 1 in.
Wheels, etc.—Dia. of driving wheels outside of tire, 56½ in.; driving box material, cast steel.
Boiler—Outside dia. of first ring, 67[illegible] in.; working pressure, 200 lbs.
Firebox—length, 108 in.; width, 72 in.; depth, front, 72¾ in.; back, 6[illegible] in.; plates thickness, sides, 7/16 in.; back, 7/16 in.; crown, 7/16 in.; tube sheet, ⅝ in.; water space, 4 in. front; 4 in. side; 4 in. back; crown staying, radial.
Tubes—material and gauge, No. 11 B. W. G.; number, 335; dia., 2 in.; length, 14 ft. 7 in.
Heating surface—tubes, 2,539.3 sq. ft.; firebox, 170.1 sq. ft.; total, 2,709.4 sq. ft.; grate surface, 54.0 sq. ft.
Smokestack—inside dia., 18½ in.; top above rail, 15 ft. 3½ in.
Tender—weight, empty, 56,100 lbs.; wheels, dia., 38 in.; wheel base, 20 ft. 11 in.; tender trucks, 2-4 whl., Fox pressed steel; water capacity, 7,000 U. S. gals.; coal capacity, 15 tons.

Making Light of a Heavy Train.

An engineer came into the big repair shop on the Rock Ballast & No Dust Railway the other day and began boasting about the fast time he had made last week on passenger, pulling an extra coach. When asked for particulars as he expected and wished to be, he explained that the extra coach was the general manager's private car. He said he had not increased the tractive effort of the locomotive one particle, and that the ratio of tractive power to adhesive weight was just as it always had been, but that the G. M.'s car had a sort of a mysterious, secret, automatic accelerating apparatus hidden away in it somewhere which always produced "results." Although hauling that car added perhaps some 100,000 lbs. to the weight of the regular train, yet it diminished the delay at stations, as much as side doors would on a suburban train.

When the hidden accelerator got in its fine work, it caught all the telegraph operators along the line and they, one after the other, telegraphed ahead some such expression as the "G. M. on No. 5," or "I. C. Thruer's car's on 5," or "Thruer's going through," but whatever was said the effect was the same at each station. The baggage was all brought out and piled on a truck just on the very spot where the baggage car door would come, and when the train stopped the station baggageman called loudly for assistance and tackled the trunks with intention. The station agent perhaps lent a hand, and before the train was well stopped the conductor was on the ground yelling "all aboard!" and the brakeman had helped passengers off and others on, and the train mail followed the last trunk in with a rush and there was a general air of hum and go about the station which contrasted oddly with the deliberate actions of the men on the preceding and following train when they had occasion to do business there.

"Oh, yes," said the engineer in conclusion, "the hidden accelerator in the G. M.'s car is great, it fairly beats the band, it can push you through on time against a heavy head wind and against conditions where a double header would stall, for it's continuous in its action at each station and awful powerful, and it never gets out of repair."

HEAVY CONSOLIDATION ENGINE FOR THE ILLINOIS CENTRAL.

Chemistry of Coal.

Prof. S. W. Parr, of the University of Illinois, has just succeeded in devising a method for the determination of the amount of sulphur occurring in coal. As the coals of this State contain from one to five per cent. of sulphur, and that element indicates the amount of clinker, this new process is bound to be extremely valuable. Prof. Parr has also discovered a means of arriving at the total amount of carbon in coal and other combustibles, a matter of the highest importance to operating engineers, who need to know precisely how much energy a given fuel ought to yield.

The calorimeter, which Prof. Parr invented a few years ago, is to-day universally used in the mines, factories and technical schools of this country and has been widely adopted in foreign countries. —*Press Bulletin University of Illinois.*

Growth of the Locomotive.

BY ANGUS SINCLAIR.

(*Continued from page 304.*)

COLONEL LONG'S FIRST LOCOMOTIVE.

In 1830 Colonel Long, president of the American Steam Carriage Co., built in Philadelphia a locomotive which had a boiler with a combustion chamber in the middle, but otherwise it resembled the improved English locomotives. In working order the engine weighed about 8,000 pounds. It was tried very exhaustively on the Newcastle & Frenchtown Railroad, but its performance resembled that of a pioneer Scotch locomotive, which the builders wished to recommend through the influence of Napier, a celebrated engineer. Napier had been invited to witness the test of the locomotive which had been designed by an ambitious amateur. The promoters of the engine succeeded in bringing Napier into the presence of capitalists; but when the attempt was made to have the engineer testify in favor of the engine's performance nothing was forthcoming but a succession of protesting grunts. Losing patience the inventor exclaimed, "You must admit that you saw the engine running." "You may call that running," replied Napier, who stuttered. "all I saw was you fellows sho-shoshovin' her."

The trials of Long's engine were a succession of failures because the boiler would not make the steam required I believe that was the first engine with a combustion chamber, the most deceptive device ever applied to a locomotive boiler. A designer could prove by the most convincing reasoning that a combustion chamber must improve the steaming properties of a boiler and effect saving of fuel, but experience has always proved it to have the opposite effect.

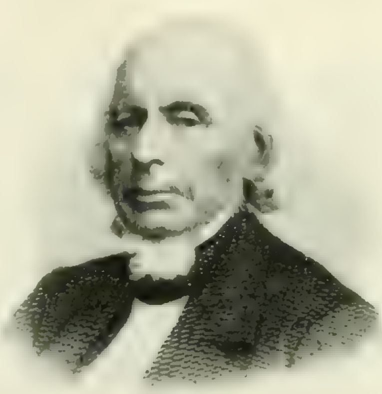
LONG & NORRIS' "BLACK HAWK."

Col. Long was by no means discouraged by the failure of his first locomotive, but entered very cheerfully with William Norris into what was intended to be a permanent business of building locomotives. The records now to be found concerning the early locomotives built by Long & Norris are very meager. Their first engine which they built was called the "Black Hawk." It was designed by Col. Long and was an extraordinary production. The designer aimed at novelty and succeeded in making a locomotive different from anything built before or since. There was not then much of a beaten path in locomotive designing, and what there was he disdained to follow. He proposed burning hard coal by natural draft only, and employed an unusually high chimney which could be lowered when passing under bridges. Later on he made the chimney telescopic and obtained a patent on the invention.

The boiler was peculiar and consisted of two cylinders, about 20 inches diameter, secured side by side (as was also done by Horatio Allen) and forming the roof of a detachable firebox which had water sides but no crown except that formed by the bottom of the twin boilers. A notch was cut half way through these two cylinders on their lower half diameters, about midway of the length of the firebox, directly over the fire, and from these notches flues about two-inches diameter and about seven feet long, passed through the water space of each cylinder portion of the boiler to the smokebox. The fire gases had another passage besides the flues, for a channel was provided to let them flow under the boilers to the smokebox.

The engine was carried on four wheels and had inside cylinders with crank axle. A cam cut-off, then greatly in favor on the engines of river steamers, was used.

The Long & Norris engines were not much in demand in the first few years of the firm's history. Col. Long retired in 1834 and William Norris brought engineering skill into the concern that greatly changed the reputation and worth of the engines built.



MATTHIAS W BALDWIN.

THE JAMES LOCOMOTIVE.

When Philadelphia was stirred up with locomotive designing schemes in 1832, a candidate for honors as a locomotive designer and builder was busy in New York. This was William T. James, who built the sixth peripatetic engine turned out of his shop, which was a most remarkable engine in some respects. An authentic drawing of this engine has been preserved, and its reproduction is shown in Fig. 29. As will be seen, the engine was carried on an oblong wooden frame, resting upon four wheels. The boiler was upright after the Baltimore & Ohio fashion, for which it was intended, but it had no flues, the principal heating surface being in the firebox. The cylinders, 10 x 10 inches in front, were set at an angle of 30 degrees and transmitted the power through a supplementary shaft which engaged with the driving axle by gears of two sizes that were intended to increase the power or the speed as required in the same way that automobiles are now constructed.

The striking feature of the engine was the reversing gear which was the link motion, operated by two fixed eccentrics, the link being afterward lost sight of and reinvented ten years subsequently by William Howe, a workman in the works of Robert Stephenson & Co., Newcastle. There is no question that the link was first invented by James and that he understood its peculiarity of varying the point of cut-off, an action which was first discovered when they were setting the valves. The writer has frequently talked with Samuel B. Dougherty, who was foreman in the James shop and an intelligent helper and adviser, concerning the construction and designing of pioneer railroad machinery. Dougherty lived till about 1890.

DIVERSITY AMONG PIONEER LOCOMOTIVES.

In 1832 it looked as if there would be as much diversity in the general appearance of locomotive engines as there were in the marine engines up to that time. No locomotive had appeared in America to set the fashion as the Rocket did in Europe. Cooper's Tom Thumb had vertical engine and boiler, so it was natural that the type should have imitators, although a vertical engine, more especially a vertical boiler, was not adapted to a moving engine.

The first locomotive built for practical work, the Best Friend, had a vertical boiler, but the second engine built under the same supervision, the West Point, had a horizontal boiler, and the Baltimore & Ohio made their standard locomotives for years with upright boilers. The DeWitt Clinton, the third locomotive built by the West Point Foundry Company, had a horizontal boiler, but nothing about it indicated that the designer was not original in his ideas. There were five locomotives, built for the purpose of competing for the reward offered by the Baltimore & Ohio Railroad Company, and none of them had any resemblance to each other, the only common grounds of all designs being that they had boilers for steam generation and mechanism through which it was intended that the steam should produce locomotion, although it did not always accomplish that.

BALDWIN'S "MILLER" ESTABLISHED A NATIONAL TYPE.

Confusion and uncertainty reigned among locomotive designers as to the fittest form such an engine ought to have, until Baldwin built his second engine in 1834. There were freaks afterward brought forth that departed radically from the design of the "E. L. Mil-

ler," but they exerted no influence on the development of the American locomotive. The American locomotive of to-day was developed directly from the E. L. Miller, just as certainly as a huge oak tree grows up from the small acorn.

An engraving of the E. L. Miller appears in our April number, page 164. The leading features are a horizontal boiler with Bury's haystack firebox, one pair of driving wheels, located behind the firebox, a four-wheel swiveling truck under the smokebox, and outside wooden frames sheathed with iron plates. The cylinders, 10 x 16 inches, are secured between the smokebox and frames, and transmit the power to the driving wheels through a half-crank axle, Fig. 30. This is a decided improvement in crank axles, for the wheel is made to form one side of the axle, thereby materially strengthening what had come to be considered a weak member of inside-connected locomotives. The engine weighed in working order about 16,600 pounds.

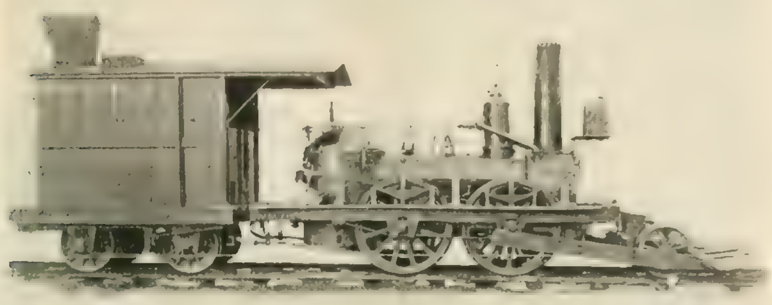


FIG. 28. THE JOHN BULL OF THE CAMDEN & AMBOY RAILROAD.

BALDWIN'S VALVE GEAR.

The valve motion was given by a single fixed eccentric for each cylinder. Each eccentric strap had two arms attached to it, one above and the other below, and, as the driving axle was back of the firebox, these arms were prolonged backward under the footboard, with a hook on the inner side of the end of each. The rocking shaft had arms above and below its axis, and the hooks of the two rods of each eccentric were moved by hand levers so as to engage with either arm, thus producing forward or backward motion. This form of single eccentric, which was peculiar to the Baldwin engines, was preferred in the interest of simplicity in the working parts and was used for many years.

The E. L. Miller had very little that was decidedly original, but old forms were combined in a shape that produced the best locomotive engine then built. Many other highly successful inventions have been worked out in a similar manner, among which may be mentioned Stephenson's Rocket, the consolidation safety valve, all modern injectors and sight-feed lubricators.

BALDWIN'S DRIVING WHEELS.

The leading policy which Mr. Baldwin adhered to, as a locomotive builder, was to reproduce the same general form of engine and to effect improvements on details. The pioneer railroad companies had experienced much annoyance from the driving wheels failing. Baldwin invented a wheel, Fig. 31, in which the hub and spokes were of cast iron, cast together. The spokes were cast without a rim, and terminated in segment flanges, each spoke having a separate flange disconnected from the others. By this means the injurious effects of unequal expansion and contraction was prevented. The flanges bore against wooden felloes, made in two thicknesses and put together so as to break joints. Around the whole the tire was passed and secured by bolts. This made a good wheel which held its own until the molder's art advanced sufficiently to cast a reliable cast iron wheel center.

GROUND PIPE JOINTS.

One of the most valuable inventions which Mr. Baldwin introduced early in his career, was ground pipe joints. All other locomotive builders made joints of canvas and red lead, which were continually blowing out, causing annoying delay and materially increasing the cost of maintenance. The trouble with the steam joints prevented the English builders from carrying more than 60 or 70 pounds boiler pressure without danger to the joints, while the Baldwin engines were carrying 120 pounds without trouble. The red lead joints gave so much trouble with three English engines on the Pennsylvania State Railroad that they had to be sold because the enginemen refused to run engines that failed so often.

OUTSIDE TUBE FERRULES.

Another very important improvement introduced by Mr. Baldwin was in boiler tubes, which consisted in driving a copper ferrule or thimble on the outside of the end of the tube and soldering it in place, instead of driving a thimble inside the tube end. The new practice strengthened the end of the tube and left the inside unobstructed, so that cinders passed freely out.

TRACTION INCREASER.

In 1834, Mr. E. L. Miller secured a patent on a traction increaser, which transferred part of the weight of the tender upon the driving wheels. Mr. Baldwin applied this device to many locomotives, and subsequently purchased the entire right to use the invention.

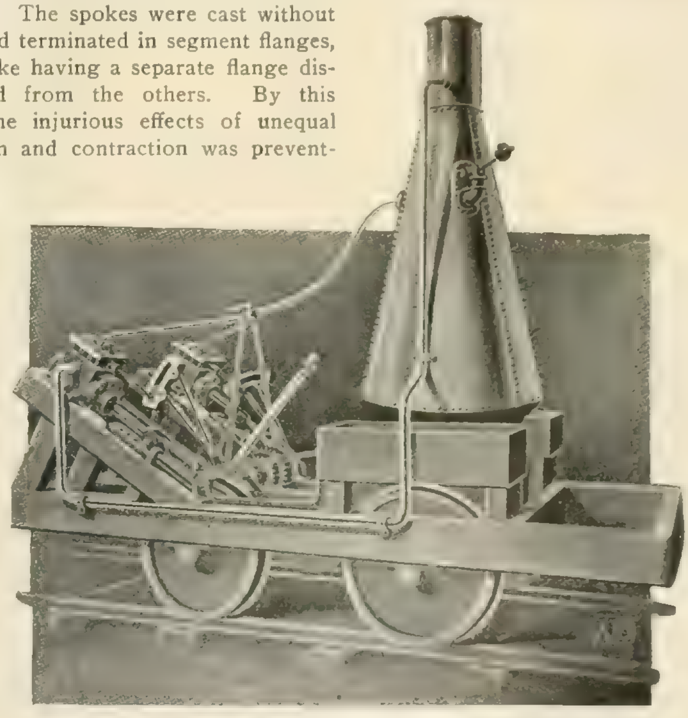


FIG. 29. JAMES' ENGINE, 1832

Among the tentative improvements introduced on Baldwin's early engines.

were a set of brass tires which he supposed would increase the adhesion, but they wore out so rapidly that they were abandoned for iron. The tires, made by S. Vail & Sons, Morristown, N. J., the only American maker, and those imported from England were very thin, only about 1½ inch. Baldwin ordered a supply from England three inches thick, and had very great difficulty in getting the order filled.

The making of cylindrical pedestals was early introduced, pedestals and axle boxes having been finished on a lathe, a method which was cheap and ensured a proper fit. Chilled wheels were introduced as a means of increasing the durability of the engines.

Good workmanship and attention to details made the Baldwin locomotives unusually popular. Mr. L. A Sykes, engineer of the New Jersey Transportation Company, wrote, in 1838, that he could draw with his engine twenty, four-wheeled cars with twenty-six passengers each, at a speed of twenty to twenty-five miles per hour over grades of twenty-six feet per mile. As to simplicity of construction, small liability to get out of order, economy of repairs and ease to the road, Baldwin's engines stand unrivaled. He considered the simplicity of the engine, the arrangement of the working parts, and the distribution of weight, far superior to any engine he had ever seen, either of American or English manufacture. Had no hesitation in saying that the Baldwin engine will do the same amount of work with much less repairs, either to the engine or the track than any other engine.

(*To be continued.*)

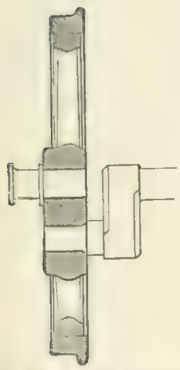


FIG. 30 HALF CRANK.

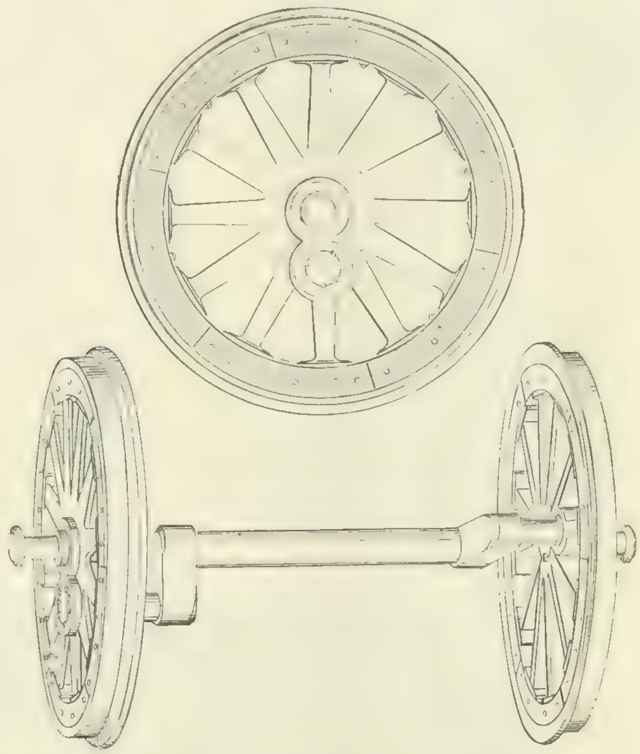


FIG. 31. BALDWIN'S IMPROVED DRIVING WHEELS.

Drawbar and Buffer Attachments for Use Between Engine and Tender.

Mr. Henry Bartlett, superintendent of motive power of the Boston & Maine, presented an individual paper at the recent meeting of the Master Mechanics' Association on drawbar attachments between engine and tender. Mr. Bartlett in his opening remarks quoted Mr. W. H. Marshall to the effect that "it is found, out on the road with a skilful engineer on an engine that the tensile and buffing stresses seldom exceed 50,000 lbs. and 80,000 lbs., respectively; with a less skilful engineer, however, the stresses increased to about 70,000 lbs. and 150,000 lbs., respectively."

The fundamental elements, Mr. Bartlett says, of a drawbar attachment between engine and tender are essentially three: (1) The drawbar itself, which receives the tensile stresses. (2) The buffers or chafing irons, which receive the stresses of compression or impact. (3) The safety device which comes into play only in case of failure of the drawbar.

An examination of the designs used on a good many roads revealed the fact that uniformity of practice has not been brought about, nor, in general, has sufficient capacity been provided for modern requirements. From a table prepared by the writer, showing relative strength of the drawbars and tractive power of the engine, and from suggestions made by numerous motive power officials, it would seem reasonable to recommend that the working stress should be 4,000 lbs. per square inch of section for straight drawbars. When large offsets occur, concessions in the factor of safety must be made, and in such cases it would be reaonable to set 12,000 lbs. per sq. in. as the maximum permissible limit. Using 28,000 lbs. per sq in., as the probable ultimate strength for repeated stresses of tension, this would indicate that the strength of the drawbar is from 7 times to 2⅓ times the tractive power of the engine.

Considering the buffing feature or the compressive stresses Mr. Bartlett said that no form of spring buffer had proved thoroughly successful. He questioned the soundness of the principle upon which this form of design now stands. The presence of the spring means a space between engine and tender, and as the spring is inadequate the space simply becomes "slack" or just that much lost motion. He thought we should bend our energies toward the production of a design which would eliminate this lost motion. One suggestion was to use some form of coupler after the fashion of the M. C. B. vertical plane device, modified to suit engine and tender.

Electric Motors for the Baltimore & Ohio.

After considerable unexpected delay two electric motors built by the General Electric Co., at their shops in Schenectady, for the Baltimore & Ohio Railroad have been delivered. They are intended to operate the railroad company's tunnel at Baltimore and are remarkably powerful motors. They weigh 75 tons each and develop 1,500 horsepower when working slowly on a heavy pull. Their tractive power is sufficient to pull the drawbar out of any car made. They are built so that every part is interchangeable and can be supplied from stock kept on hand for the purpose.

It is very fitting that the Baltimore & Ohio should be the first steam railroad to employ electric motors for regular traction purposes, for the first electric locomotive ever built was run on the Baltimore & Ohio. That was in 1851. Dr. Page, of Baltimore, was the inventor. It was a four-wheeled motor and made several trips successfully, but the inventor's ideas were ahead of his time and the project was abandoned for want of public support.

The Rogers Locomotive Works of Paterson filed a certificate in the Secretary of State's office last month increasing its capital stock from $1,600,000 to $2,000,000. There are 20,000 shares of stock. Of these 10,000 shares will be preferred and 10,000 common.

General Correspondence.

"The Kansas City Flood."

The views herewith shown of flood situation in Kansas City were taken June 1, after water had subsided some four feet, the continued cloudy and rainy weather preventing photographers from making photographs when flood was at its height.

View 1 shows State Line street looking south from elevated road. When water was at highest point as shown by marks on the brick building to right, it was just level with eaves of box cars, the current moving at rate of eight miles per hour causing the accumulation of debris to left of cars.

FIG. 1. STATE LINE STREET, LOOKING SOUTH

Views 2 and 3 show the now famous "Sante Fe sink hole," which was formed by counter currents of water meeting and eddying around several Sante Fe engines left standing in the yard of that company. The eddy that formed this hole, 35 feet deep and covering an area of about 1½ acres circular in shape, was so vicious as to capsize a skiff, drowning one man. The Sante Fe people did not know what the hole contained until they pumped it out, finding five Pullman cars and four engines, one a switcher, one simple passenger 4-6-0 type, two compound 4-6-2 type, and one compound consolidation not shown in views presented.

Behind view 2 can be seen the shops of the 'Frisco system in which the water reached a level of 7 ft. 1 in., leaving when it receded a mass of refuse, dirt and slime.

A glance at these pictures will show what the flood did to operating expenses for the Kansas City roads!

View 4 shows 'Frisco system bridge No. 1 loaded with coal cars, Armourdale in the distance, the large buildings, packing houses. This view taken after water had subsided four feet. View 5 shows the Kaw river pumping station after water had fallen, admitting of firing boilers. The black smoke was a welcome sight to a city that had been for days without water, gas, street cars or electric lights, in fact in a condition similar to a city besieged.

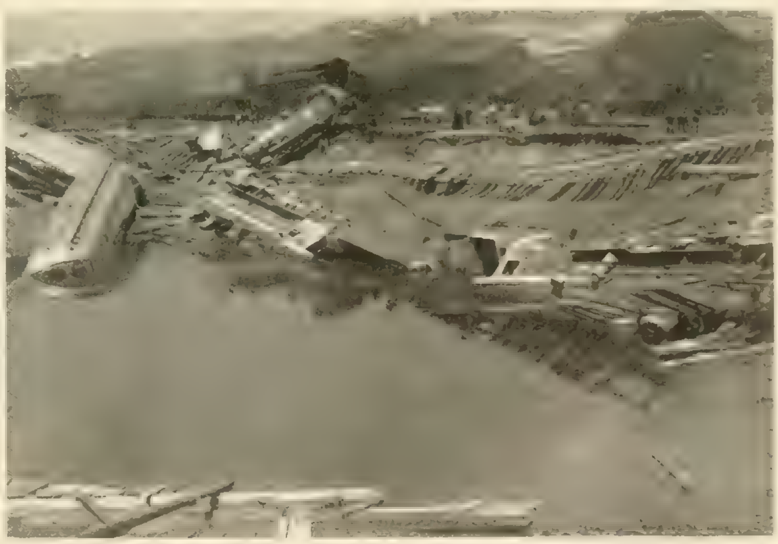


FIG. 2. VIEW OF THE "SANTA FE SINK HOLE."

The expanse of water submerging the Schwarzschild-Sulzberger packing plant covered the village of Argentine, wrecking thousands of homes, the property of packing house employees. The flood from Topeka, supplemented by heavy and continuous rains, proved too much for the Kaw river. The mighty Missouri up to and beyond the danger line, unable to care for this addition, combining with the lesser Kaw worked havoc among the many industries that have gone to make Kansas City what it is.

Among the heavy losers were the Missouri Pacific, Sante Fe, San Francisco, Rock Island, Burlington and Union Pacific Companies, and prompt restoration of traffic brought about by stupendous effort on the part of the officials of the lines centering in Kansas City, will fill an earnest page in the history of railroading.

After a flood 7 feet in depth, with a current ranging from 8 to 14 miles per hour pouring its avalanche of dirt and wreckage for days over a yard equipped with an interlocking plant such as is in use in Kansas City subsides, there is work to do and lots of it. The daily papers spoke of railroad officers who pumped hand-cars into holes, the water rising to their breast, searching with prod poles for bridges that might be gone, one general superintendent walking into the Union Station for miles ahead of an engine and train of passengers, feeling the way foot by foot until the train stopped in the Union Depot in a foot of water, the whistles screaming out

the news that Kansas City was again part of the great commercial world.

Amusing instances might be recorded, among which was the unloading of a car of pineapples by the Superintendent of Transportation of the Frisco System, the car submerged to the eaves, the freight taken out through holes cut in the roof and rafted to terra firma; this gentleman saving the fruit and $500 freight charges. The passing around of several cars of dressed beef that had spoiled for want of ice, the railroad companies compelled to keep it moving until the packing house people could get it in their fertilizing tanks.

FIG. 3. THE "SANTA FE SINK HOLE."

The first shops to resume operations were those of the railroads, and in addition to their own work, the amount of which was sufficient to appal, they rendered "first aid" to the water company, the light company and others situated in the bottoms. Millions of dollars were lost in this six days' flood that exceeded even the famous flood of 1844.

EUGENE MCAULIFFE.

Setting an Eccentric on a Hook Motion Engine.

I have just received a letter from an old brother engineer who it seems wrote me at once after reading my article in the June number of RAILWAY AND LOCOMOTIVE ENGINEERING on "Slipped Eccentrics." Thinking it might interest your readers I herewith quote the letter in full.

Fond Du Lac, Wis., June 6, 1903.

J. W. Reading, Dear Sir—

I have just been reading about setting eccentrics which made me think of old times. I set a loose eccentric in '47. I was firing a drop hook "Hinckley," the first engine with 4 drivers; had a reverse lever, 2 valve levers and a cut-off lever. I had been firing 11 months when the superintendent set me running. I ran a few months, but the M. M. had a "pet" and he set me back firing. The engineer (a new man) did not know any more than I did about setting eccentrics. We had one get loose and he could not set it; he tried it twice, but it was no go. I told him I could set it and not get off the foot board, and he said "you can set hell." The conductor told him to let me try it, I set it and told him to go under and tighten set screw, the conductor told him to set them up and he did it; when he came out from under engine I moved her ahead a few rods, then back and coupled onto train, whistled off brakes and engine went off all right.

The engineer was a "Mum" Englishman after that, but I learned to set valves and eccentrics beginning with that experience.

I am the oldest living engineer who ran an engine through New Hampshire and Vermont, and between Chicago and Lake Superior on the C. & N. W. I am 80 years old Oct. 2, 1903. I was born in Chichester, N. H., October, 1823. I ran the first train over the divide of Green Mountains in 1848.

I would like to have some one tell me how I set the eccentric.

Yours truly,

BENJ. GARVIN.

Here is a venerable old brother engineer, who, in the first days of his railroading, learned something that thousands of engineers since have failed to acquire.

There are but few locomotive engineers alive to-day who handled the old "hook motion" engines in the '40s, and I wish it could be my pleasure to meet with all the old-time lads and hear the story of their railroad days. Who of the readers of RAILWAY AND LOCOMOTIVE ENGINEERING knows this venerable, aged, brother, and what brother of his acquaintance can get the history of his early railroad days and give it to the readers of your journal? I am not prepared to voice the sentiment of the thousands of the readers of the "L. E.," but I am strongly of the opinion that the biography of these old-time brothers would be intensely interesting to a majority of the subscribers to one of the best, if not the best of all railroad periodicals.

J. W. READING.

How Tom Burke Won His Spurs.

BY SHANDY MAGUIRE.

One beautiful moonlit night in August, a few years ago, Ed Townsend, Tom Burke and "49" were running down Archer's grade, with the through freight, on time. Ed. was using a light throttle, just enough to keep the links stretched and the cylinders lubricated. Tom had a tank of good coal; and he was perched upon his seat with his back reclining against the back-board of the cab, "49" being a McQueen, and constructed so as to give the men a little comfort whenever they had an opportunity to take a spell off, the same as on this especial evening. Tom was looking ahead in a dreamy sort of a way and singing in a good voice one of Moore's sweetest songs, "Believe Me if all those Endearing Young Charms," and Ed. listening.

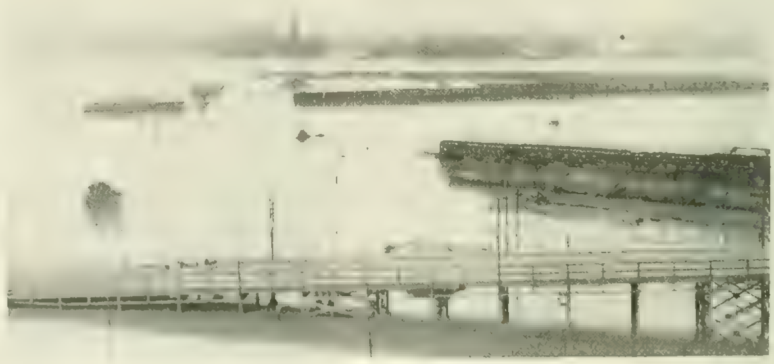


FIG. 4. FRISCO SYSTEM BRIDGE LOADED WITH COAL CARS.

"Tom. you're a good singer," said Ed., when the song was finished.

"It's kind for me, Ed., I came from the land of song."

"I suppose all you Irish are good singers?"

"Do you? If some of 'em were to be obliged to sing for cold hash, they'd starve to death."

"How are you and Nick Miller getting on now? I have heard nothing lately."

"First rate. I got onto the whole racket last pay night, and charged him with it. He was mild enough. I heard afterwards that he told Jack Eldridge he didn't want to lick me on account of the new train that is going to be put on. He expects to be set up, he being the oldest man, and he doesn't want to do anything to me to lessen his chances."

"Is it true that after you had '49' all thoroughly cleaned, and the paint work of the cab washed, that he sneaked into the round house and smeared her all over with oil?"

"No, Ed., it is not. He hadn't the courage to do it. Sneak like that he is; he gave Jack Langan a half dollar to do it, and promised the lad he would boost him into a cab to go firing if he did it and kept still about it. Now, Nick never took kindly to me since I came firing for you. I have tried to keep my engine clean and suit you, so as to make our work pleasant, for Ed., if the two men who are in the cab do not pull together, and help each other out, they not only suffer themselves, but the service suffers also. It does not hurt me to keep the deck clean, the coal wet down, the brass in here at its natural color, the boiler head black, and to keep a nice piece of clean waste stuck between the head of the reverse lever and the latch for you to wipe off your hands after you come up here from oiling round. You have been singing a song, Ed., of what a clean chap I am, and all Nick can hear from Jim Lathrop from the time they go out of the yard till they get back, is how handy things are kept for you, and the dirty devil-may-care-way in which he does his work. This got him to hating me worse than the devil does holy water, and watching his chance to thump me, when he catches me out with the gang."

"He can't do it, Tom, from my way of thinking, although he is counted handy with his dukes."

FIG. 5. THE KAW RIVER PUMPING STATION.

"That's the truest thing you ever said in your life. If I can't make his face look like a hand-ball alley after a game with a wet ball, I'll go tamping ties the rest of my life for punishment."

"Who told you all this?"

MAIN STREET IN FRONT OF RAILWAY STATION. WATER 7 FEET DEEP. CURRENT 14 MILES PER HOUR.

"Ed., you're no squealer, I'll tell you: Dickey Reilly."

"How came you and Dickey to be so thick?"

"Can't you guess?"

"No."

"Kittie."

Ed. gave a low monotonous whistle and said: "That's how the cat jumps, eh? Well, Tom, I wish you the best of good luck. Kittie is a peach if ever there was one. Amongst a whole orchard full, I'd pluck her first."

"That's what I did. I am glad you like her, she's as good as they make."

"When is it coming off?"

"Cut her up a notch or two; you're gettin' so interested, there'll not be a bit of fire on the grate-bars, and choke off the pump, or we'll have a deck load of water in the stack, and I'll tell you: One week from next Sunday night; and I want you to 'stand up' with me. Are you willin'?"

"Indeed, I am, and I'll take the first kiss from Kittie once she is Mrs. Burke, or die trying."

"You're welcome to it, Ed. It will be your first and last, for Kittie knows her place."

"That's so, Tom. I know her since she was a little toddler, and I always admired her growing up to be a comely lassie. It seems that by your going to be married on a Sunday night you intend it to be a private affair?"

"None but the immediate friends of the family, as they say in the papers. Arrah, listen!"

(Tom drifted into a rich broad brogue as natural as a duck sliding down a mossy bank into water, when he got interested in a conversation. He had a flow of good language talking to strangers, but with familiars, the brogue suited him best.)

"I went to see Father Tom O'Leary a few nights ago. 'I'm glad to see you, Tom,' says he. 'I return the same compliment to you, Father,' says I. 'I suppose you came to give me a ten dollar bill to help paint the church,' says he. 'The devil a cent, Father,' says I. 'Now, Tom, you are gettin' big pay on the railroad, compared with the rest of my poor people, and you ought not to be so stingy.' 'If I am I earn it. If you had to throw coal into "49's" firebox.' says I, 'with 25 loads behind her, and

keep her clean for deserts, you'd find it a divilish sight harder work to get dollars out of the job than thrustin' the collection box under our noses in church. Faith, it's the good job you have, and the ould woman missed it when she didn't prepare me for Holy Orders.' 'Did you come here to abuse me?' says he. 'I did not, Father,' says I. 'It isn't in me breed to abuse one of your cloth. I came here to make arrangements to get married.' 'Who is the girl?' says he.

BLOSSOM HOUSE IN FRONT OF UNION DEPOT. FLOOD PUT TICKET BROKERS OUT OF BUSINESS.

'Kittie Reilly,' says I. 'One of me own flock, God bless her. So you want me to publish the banns?' 'I want you to do nothin' of the sort,' says I. 'Do you suppose I am goin' to have a whole church full of gawkers lookin' at us as we walk up the aisle to the altar; what we wear and how we act? Then a lot of invited guests come to the house, this one bringin' an ould chair, another a knife and fork, another a few spoons, and so on; then, bime by, if we don't happen to please them, goin' round the town tellin' this one and that how they helped us to go housekeepin'? No, Father, I'd rather use an ould three-legged stool for our parlor rockin' chair than take any of their presents. When it comes to beggin' I'll go from house to house and be honest about it.'

"'That's right, Tom,' says he, 'and I agree with you. I'll get a dispensation from the bishop and be ready when you call.'

"Now, Ed., I've tould you all; and one week from next Sunday night come and witness Father Tom tyin' the knot I never can open with me teeth. Have Mrs. Townsend at the house, and we'll have a cup of tea together when it's all over."

About one month after Tom's marriage he received a letter from the Master Mechanic to be at his office at 10 A. M. the next day.

"Arrah, what's up, Ed.?" he said on the trip out the day he got the letter. "Faith, I don't know of doing anything to be called to the office for, unless Nick Miller and the gang have worked up something agin me."

"I didn't hear," said Ed., with a cold look on his face, not at all reassuring to Tom.

"Mr. Burke," said Master Mechanic Dawson to him on the day in question, "I have watched you very closely, as well as I have and am watching others in the employ. You have always attended to your business faithfully and soberly, and I have never known you to resort to any method of obtaining what is known as 'a pull' for your advancement in the service other than attention to duty, which is far and away ahead of everything

LINE MEN ARE ALL RIGHT, BUT ARE "UP IN THE AIR."

I know of to get a step or two up the ladder. I have never heard of you agitating or being in any way connected with any clique who considers the road and engines were built for its members exclusively, instead of trying to earn money for those who invested capital to purchase them, and to keep them in running order. I am not making any mistake by promoting you. There are a few who will not be satisfied, but it is not any concern of yours. Nick Miller, the man who should be set up under our rules of seniority, all else being equal, is a continual disturber and agitator, the most pernicious of all grief hunters. Were he the tenth part as accomplished in his work as he is skilled as a pilot, who can navigate schooners of booze across a bar, without ever puncturing a bubble floating on top, until it is in Snug Harbor, securely moored, he would be the peer of the best man in the employ. I intend to give him a chance to do better, if he wishes to get ahead. Instead of dismissing him from the service I shall disrate him to the place you occupy, and advance you to the position I take him from. This will not be doing an injustice to the other men. To-morrow you will take charge of the Berwick in the Upper Yard."

Tom commenced twisting his hat around in his hand, trying to say something in reply, but at last he only succeeded in making himself understood that by being put to the running of the Berwick he would be doing an injustice to the other four men between him and Nick.

Mr. Dawson satisfied him that he could accept with a good heart, as two had expressed a wish to remain in road passenger service firing, in preference to running a yard engine, and the other two were too young to be set up.

"So then, Mr. Dawson," said he, "if I decline will you give Nick a chance? He is smart and he may do better when he gets to be an engineer."

"No, sir. You would have me act as some girls do who go with drunkards, they marry them so as to reform them?"

"Well, sir, I thank you. If I fail to please you it will not be but that I'll try hard enough."

Tom bowed himself out of the office, and with the speed of a greyhound he ran to Townsend's house, where panting and almost breathless, he managed to bluster out: "This is all your doin's, Ed."

"What's the excitement, Tom? You

look as flurried as you did the night you went out to hand oil the valves and lost the tallow pot, because you claimed you saw the ghost of Jim Skinner, that was killed on Bailey's hill."

"Arrah, Ed., instead of you kissin' Kittie, I'll have her kiss you the next time you meet. God bless you, old friend, and I say it from a heart as sincere as the priest would if you put a dollar bill upon the contribution plate, instead of a cent." With that, he shot out of Ed.'s presence, saying: "Begor I must hurry home and tell Kittie she is the wife of an engineer."

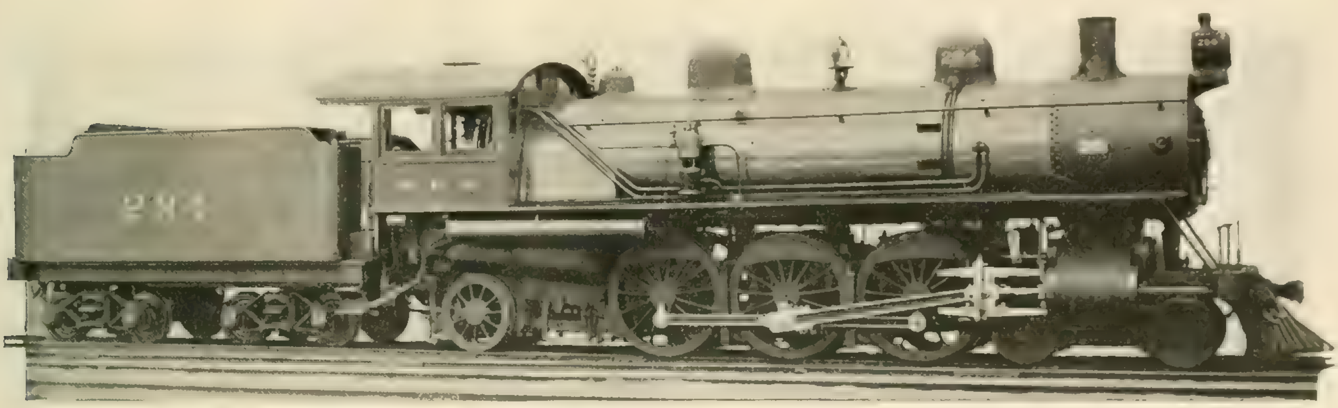
Heavy 4-6-2 Engine for the Northern Pacific.

The American Locomotive Company have recently supplied some passenger 4-6-2 engines to the Northern Pacific. These engines were built at the Schenectady shops. The cylinders, which are simple, are 22x26 ins. and the drivers are 69 ins. in diameter. The driving wheel base is 12 ft., while the wheel base of the whole engine is 33 ft.

The total weight of this machine in working order is 195,000 lbs., out of which 132,000 lbs. is carried on the drivers. The tractive effort is 31,000 lbs. and the ratio of tractive power to adhesive weight is 4.25. All the wheels on this engine are flanged. The crosshead top guide bar is lipped over so that side of crosshead and side of guide are flush, thus eliminating a dust and dirt collecting opening from the top of the crosshead.

The boiler is the straight top type with wide firebox. The heating surface is altogether 3,462.42 sq. ft., of which 3,264.3 sq. ft. are in the tubes. There are 23.02 sq. ft. in a series of water tubes and the firebox itself contributes 175.1 sq. ft. to the total. The grate area is 47.2 sq. ft. The working steam pressure is 200 lbs.

The tender, which weighs, loaded, about 123,400 lbs. is built with the ordinary steel frame. The tank capacity is 6,000 U. S. gallons. The engine and tender weigh, together, in working order, about 318,400 lbs. According to the classification adopted by the Northern Pacific, this engine is one of class Q, but according to the builders' scheme of classification the engine is referred to as 462-195. This latter method indicates the wheel arrangement and the total weight of the engine. The wheel spacing and the disposition of the vertical and horizontal lines in its design, gives to this machine a symmetrical and well balanced appearance.



AMERICAN LOCOMOTIVE COMPANY 4-6-2 FOR THE NORTHERN PACIFIC

The Mosquitoes' Song.

One of the latest scientific discoveries is, that a certain musical note, raised to a great number of vibrations per second, will completely paralyze mosquitoes. It is an intensified form of the note which mosquitoes sound so merrily while searching for victims into which to force their poisoned dart.

The scientists who are studying the habits of mosquitoes say that railroad trains and ships have been the means of transporting mosquitoes to many regions where they were formerly unknown and that they have proved fertile immigrants. This increases the number of the country's population, who are interested in the successful operation of methods proposed for exterminating mosquitoes. We know of no minor evil which so seriously interferes with man's natural heritage to follow the pursuit of happiness, as the incessant biting of mosquitoes. A great statesman once asserted that the man who made two blades of grass grow where only one had grown before was a benefactor of mankind. If the scientific gentlemen who are devising extermination of mosquitoes succeed in preventing ninety-nine of the bites of every hundred that mosquitoes are now inflicting, they will deserve the gratitude of the people and the finest monuments that suffering humanity can erect.

There are few parts of the country exempt from the mosquito pest and they are growing fewer. The writer is at home in New Jersey where the most ferocious breed of mosquitoes have their abiding place, and the discomforts of the pest are merely comparative in other places; so he can write with feeling. These insects not only cause much personal discomfort; they interfere with business. A gentleman who intended erecting a factory that afterwards employed hundreds of men, wished to locate near New York city. He was offered land on the Newark meadows and thought of locating there; but he happened to visit the Pennsylvania railroad meadow shops, and while there noticed that the workmen spent a serious part of their time fighting mosquitoes, so he decided to locate in a place where that obstacle to production did not exist.

The Erie Railroad Company are preparing to erect large repair shops in the meadows near Jersey City, the most fertile breeding ground of mosquitoes in the United States. We advise President Underwood to pause before erecting workshops in such a place unless the new method of exterminating mosquitoes is proved to be practicable. The people working on the musical note method say that the mosquitoes are attracted by the sound and fly with lightning speed to their place of execution. Every insect within reach of the sound goes there and stops not on the order of their going.

It may be that mosquito exterminating machines will come to be part of the equipment of every manufacturing concern located in mosquito haunted regions. If the buzz-saw could be tuned up to produce the murderous note, it would increase the usefulness of that enterprising tool. Be that as it may, manufacturers will not grudge the expense of purchasing a mosquito exterminating machine when its tunes will increase the comfort of workmen and at the same time enable them to do more work. The picturesque Italians who tamp the ties on some New Jersey railroads have been kept so busy fighting mosquitoes that their work on the track has amounted to nothing.

The Rushton Drifting Throttle.

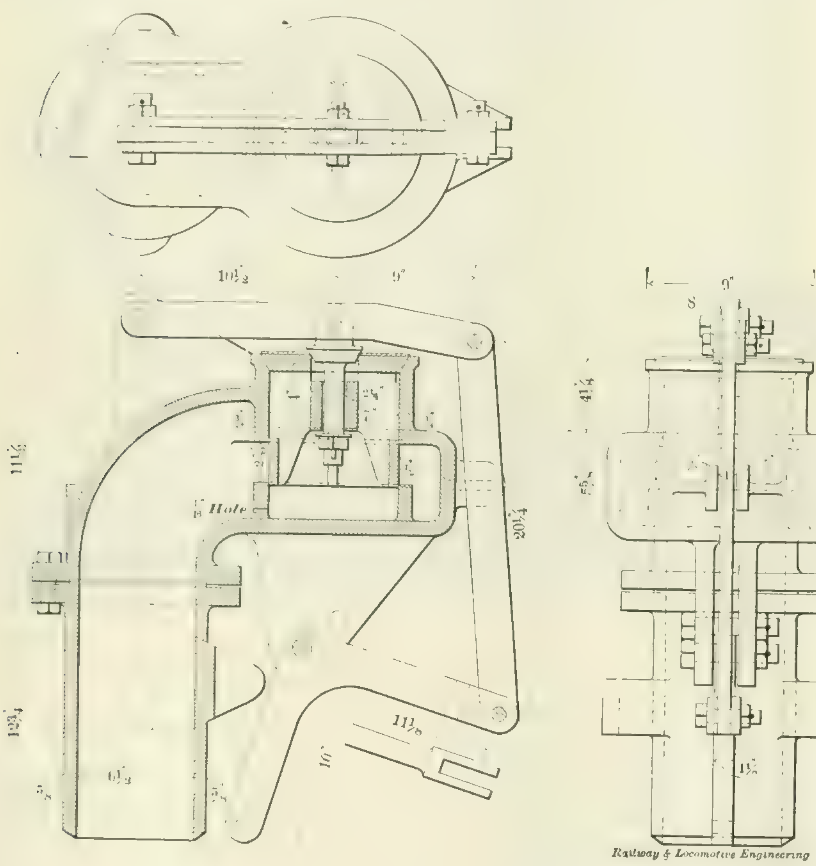
The accompanying drawing is of a locomotive throttle valve designed and patented by Mr. Kenneth Rushtown, chief draughtsman of the Baldwin Locomotive Works. The object of this device is, when desired, to permit some steam to enter the dry pipe, when an engine is drifting, for the purpose of lubricating the cylinders.

The throttle case has one external opening which is at the top, and the internal opening through which steam enters the dry pipe is a circular port 2½ ins. deep, which runs all round, and is opened only when the throttle valve itself lifts. Below this circular port is what may be called a sort of saucer just the size of the cylindrical portion of the valve.

The throttle valve has in its center a small valve which, when just off its seat, permits steam from the boiler to fill the spaces between the wings of the main valve, but as the main valve remains on its seat, no steam can pass through the circular port into the dry pipe. Provision is, however, made for the escape of some steam to the cylinders through a small hole drilled through the wall of the saucer which is below the main valve. As this hole is $\frac{1}{16}$ of an inch in diameter, it is manifest that the amount of steam passing through it will not be as great as that usually caused by a leaky throttle, yet wire drawn as it must be, the steam which does flow through, is sufficient to keep the cylinders lubricated while engine is drifting.

When it is desired to open the throttle, the lever lifts the small valve ⅜ of an inch off its seat and the nut which is on the bottom of the small central stem engages with the throttle proper, and the valve is raised. The throttle and its auxiliary valve can be shut off, and both will be held firmly in place by the pressure of the steam on top of each.

It will be noticed that this valve has only one large disk and when tightly shut off is not balanced as are the valves of usual form. When, however, it is desired to open the main valve when starting, the movement of the regulator first unseats the small valve, which from its size has only a small amount of pressure on top of it, and as soon as the steam gets inside, it reduces that pressure under the large disk, so as to make it about equal in balance to the ordinary double poppet valve.



RUSHTON DRIFTING THROTTLE.

We have received from the secretary of the American Railway Engineering and Maintenance of Way Association a copy of the specifications for material and workmanship for steel structures adopted by the association at its 1903 session. Copies may be had from the secretary, 1562 Monadnock Building, Chicago. Price of single copies, postpaid, ten cents.

Recent Improvements in Boiler Design.

The following is the first part of the report submitted to the Master Mechanics' Convention on the above subject. The committee was D. Van Alstyne and O. H. Reynolds.

Progress in boiler design may be said to be along the lines and in pursuit of increased efficiency as a steam generator, rather than in perfection of constructive details which affect first cost and that of maintenance.

The most prominent features of design to attract attention are those of heating surface and grate area. Professor Goss pretty nearly exhausted the boiler-power question when he said: "The maintenance of pressure in the cylinders demands steam from the boiler, and the limit of cylinder work is reached when the boiler can no longer meet the demands made upon it." This is all fundamental, though recent, but is in strong contrast with the old order of things where cylinder dimensions alone signified a powerful engine.

The boiler of 1903 is designed with special reference to well-defined conditions, in which the horse-power involved is provided for by a heating surface and grate area, of proportions that are expected to unfailingly supply the cylinders. That these expectations are fully met is attested by the performance of the latest engines.

The wide firebox which is rapidly becoming recognized as a standard form of construction, is responsible for the extraordinary length of tubes on engines which, on the 4-6-2 type, reach a length of 20 feet in some cases, made necessary by placing the wide firebox at the rear of six-coupled 80-inch wheels. Foreign builders are regarding with favor the trailing truck design, since they gain a grate area impossible of attainment in the older form of passenger engines, and to this is due the appearance abroad of the 4-4-2, 4-cylinder compounds of the Baden State Railway, with 42 square feet of grate, and others. The De Glehn 4-cylinder balanced compound is also of the 4-4-2 type, although it has not the firebox extending over frames, but the design of engine lends itself to such construction which will doubtless be seen on future engines of the De Glehn type.

The foreign engines have a ratio of firebox to tube surface more nearly in harmony with the work of the committee of 1897. The 4-4-2 De Glehn 4-cylinder balanced compound engine of the Northern Railway of France has made a record for development of a high horse-power on a very small heating surface, contending with 0.5 per cent. grades at a speed of seventy-four miles an hour, with 295 tons of engine and train. More than 1,500 De Glehn engines are now in service. The 0-10-0 3-cylinder simple engine of the Great Eastern Railway has boiler

proportions of the greatest magnitude of any of the foreign engines, having been designed for suburban passenger service in which stops are numerous, and with a gross load of 414 tons. This work requires the engine to accelerate quickly, therefore the small wheels and large boiler, the latter feature being an innovation in English design.

The London & Southwestern Railway has more than one hundred of the Drummond water-tube boilers in service, and it is stated that all locomotive boilers of this road are now being fitted with cross water tubes. Under this system, the fire-box heating surface is increased nearly one hundred per cent. by means of the water tubes, and equals 30.8 per cent. of the total. This would appear to be a practical illustration of the ancient proposition, that the higher the percentage of fire-box heating surface to total heating surface, the greater the evaporative efficiency of the boiler, a logic that remains to be controverted. A boiler of this character, but with water tubes in the fire-box only, has been designed by Mr. Riegel, of the American Locomotive Company. This system contemplates two nests of water tubes extending from center of crown sheet diagonally down to side water spaces, by which it is claimed to be possible to get over 1,800 square feet of efficient heating surface in the fire-boxes of the larger types of engines, making a total heating surface of over 6,000 square feet. There is no doubt of the necessity of such a design, since fire-boxes have about reached the limit of size, both from a clearance standpoint as well as that of operation. There is no record of any construction of this idea.

Superheating of steam is attracting considerable attention abroad, particularly on the Prussian State Railways, where seventy engines are fitted with the Schmidt system of superheating. In addition to these the Schmidt principle is in use on the Alsace-Lorraine State Railways, the Belgian State Railways, the Moscow-Kasau Railway, the Southern Railway of Italy, and the Munich Suburban Railway. In this country the same superheating device is in use on the Canadian Pacific, and the American Locomotive Company is now constructing another engine similarly equipped for the same road. It is understood that there are also five of these engines under construction by the Pennsylvania road. Very glowing accounts of the performance of Schmidt engines, by an American engineer who has recently returned from Europe, would imply that there were economics in superheating of steam for locomotives.

Even with the successful overcoming of resistance at continuous high speeds there is a question among some officials that, while we have ample heating surface, it may not be in the right place, or, in other words, it is possible that we have too much heating surface in the wrong place, that is, are not too many tubes used, and would not a boiler furnish an equivalent or a higher evaporation with a lesser number? There appears to be good reasons for questioning the efficiency of a multitude of tubes, among which are the following for reducing the number: A better circulation due to the wider spacing of centers; a reduction of liability to leakage, and longer life to tube sheet due to the greater section of material between holes. It is not apparent that there are any very serious difficulties to surmount in making tests that will demonstrate to what extent evaporation and cost of maintenance is affected by a wider spacing of tubes. Such experiments would definitely decide whether the practice of encroaching on circulation space with tubes is conducive to an economical evaporation, and in addition would no doubt incidentally furnish some needed light on the effect of a higher ratio of fire-box to tube heating surface under the new conditions. Restricted water spaces around the firebox are well known to be inimical to a proper circulation, as well as dangerous to the sheets, and the same effects are known to operate at the fire-box ends of tubes. The wide fire-box has shown a marked tendency to crack at the sides, and as a remedy it is proposed to make the fire-box ring 4½ inches wide on some engines now under construction.

In bracing and staying there is little to be recorded as new. In joint construction the welt type is said to be improved to an efficiency of 90 per cent. of the solid plate, and welding of joints is said to be satisfactorily done, both on dome sheets and longitudinal joints, the latter, however, not continuous but at ends only.

The reason for the increase of heating surface being one of boiler power to meet the greater demands of the cylinders, it is plain that the question of design should have direct reference to the amount of water evaporated by each square foot of heating surface per hour. If the heating surface is designed for the work to be done, that is, on a horse-power basis, then the problem becomes one of design for specific conditions. In that case the facts entering into calculation are:

(1) Resistance to overcome.

(2) Horse-power required.

(3) Water consumption per horse-power hour.

(4) Water evaporated per square foot of heating surface per hour.

(5) Evaporative value of one pound of coal.

(6) Grate area to accord with calorific value of fuel.

This process has to do with actual values only, eliminating all factors of doubtful utility.

Your committee is under obligation to the technical press for courtesies extended in the way of illustrations, among which are, the *American Engineer*, *Railroad Gazette*, RAILWAY AND LOCOMOTIVE ENGINEERING and London *Engineering*.

ENGINE HOUSE, MONCLOVA, MEXICO, MEXICAN INTERNATIONAL RAILWAY. GENERAL REPAIR SHOPS TO BE BUILT LATER.

Plans have been completed by the Pennsylvania Railroad Company for another important addition to the big works at Altoona. It is announced that the railroad company proposes to erect a plant for the manufacture of car wheels, which will be an innovation at the company's works. The plans provide for a building with a capacity for 600 cars a day. It is understood that the company proposes to start work on the construction of the plant at once and will have it ready for use by fall. The cost is something like $25,000. During the past year the Pennsylvania has spent over $2,000,000 increasing the facilities of the works at Altoona until they have been made the most complete railroad shops in the country.

Railway and Locomotive Engineering

A Practical Journal of Railway Motive Power and Rolling Stock.

Published monthly by

ANGUS SINCLAIR CO.,

174 Broadway, New York.

Telephone, 984 Cortlandt.
Cable Address, "Loceng," N. Y.
Glasgow, "Locauto."

Business Department:
ANGUS SINCLAIR, President.
FRED M. NELLIS, Vice President.
JAMES R. PATERSON, Secretary.

Editorial Department:
ANGUS SINCLAIR, Editor.
F. M. NELLIS,
GEO. S. HODGINS, Associate Editors.
JOS. A. BAKER,

Advertising Department:
Eastern Representative, S. I. CARPENTER, 170 Summer St., Boston, Mass.
Western Representative—J. A. BAKER, 1204 Monadnock Block, Chicago, Ill.

British Representative:
THE LOCOMOTIVE PUBLISHING CO., Ltd. 102a Charing Cross Rd., W. C., London.

Glasgow Representative:
A. F. SINCLAIR, 7 Walmer Terrace, Ibrox, Glasgow.

SUBSCRIPTION PRICE.

$2.00 per year, $1.00 for six months, postage paid to the United States, Canada and Mexico. For other parts of the world, $2.50, or ten shillings. Single copies, 20 cents. Remit by Express Money Order, Draft, Post Office Order or Registered Letter.

Mailing address can be changed as often as necessary—always give old and new address, and if you subscribed in a club, state who got it up.

Please give prompt notice when your paper fails to reach you properly.

Entered at Post Office, New York, as Second-class mail matter.

For Sale by Newsdealers Everywhere.

Why Large Engines Fail.

The problem of overcoming the too frequent failures of the large engines has been the one absorbing thought of the builder, designer and superintendent of motive power. Opinions from these different sources have been given to the public through the press of late, and in the majority of cases the cause of failure has been attributed either to the ignorance or indifference of the enginemen—due to the pooling system—or the employment of new engineers and firemen made necessary by the increasing traffic. While this is often the true cause, it is not by any means the whole reason for the failure of the big engines. Faulty design and bad water have contributed more to these failures than anything else. When engines break 500 stay-bolts in five months, or an average of three and one-third per day, there is certainly a fault in the design. On many of our roads where stay-bolts are tested only at wash-out periods, which come about twice a month, an engine breaking three stay-bolts a day is a slumbering volcano, liable to create havoc any minute. Nursing an engine to please the superintendent of motive power is not the transportation department's idea. Their instruction to the engineman is, "Never mind the engine. She belongs to the company, and we want you to pull cars and get there." With this order, the "good" or the "indifferent" engineman has no choice.

Pooling engines has been a blessing to the careless and incompetent men and a curse to the energetic and competent.

Abridging water-space in order to get more heating surface has been the prolific cause of leaky flues in the bad water districts of the West.

Pressing "handy men" into service to do experienced boiler-maker's work, in order to save expense, has caused many an engine failure, and is always an expensive sort of economy.

The engineman has no voice in the question of pooling, tonnage-rating or the employment of repair men, yet much blame is laid on his shoulders. With the advent of the large engines came a change in fire-door design, some of our "battle-ships" having two doors and so arranged that it is almost impossible for the fireman to operate them to advantage. The result has been that the fireman, unable to close the door after each scoopful of coal, and having to coax the monster with 25 tons or more of coal over the division, has adopted the opposite plan and left the fire-door open until five or six scoops at a time have been shoveled into the fire. This always means disaster to the firebox. The indifference of some of our lines to these conditions is the cause to-day of so many of their old firemen leaving their service. Breaking-in new firemen is expensive business. So long as railroads place so little value on the services of an experienced fireman, ignoring his needs in order to save a few dollars, just so long will the stockholders continue to wonder why the big engines earn so much less than they were expected to.

We must disagree with the builder who tells the public that the waters of the western states are almost certain death to those who drink them. We are familiar with the waters of California, Colorado, New Mexico and Kansas through years of experience, and know people who have been using them for twenty years without serious inconvenience. We must also disagree with the statement that 50 to 75 per cent. of cylinders in the old single expansion engines in use ten or fifteen years are banded or patched, owing, of course, to this same deadly water. Bad water will convert a steam engine into one of the hydraulic kind very often, but many of the fractures mentioned were made by defective pistons or piston-rods. Frequent inspection would have reduced the percentage. When those engines were built, we had no piston valves. Piston valves are not a success in bad water districts, because they cannot free themselves of water so readily as the old slide valves. For the sake of argument, allowing the damage to cylinders on the engines with slide valves to have been 25 per cent., the damage to the piston valve class, had there been any such, would have footed up 50 per cent.

The lack of facilities for repairs to the large engines is to be charged against the railroad companies. The lack of interest on the part of the engineers and firemen is also directly attributable to the nearsightedness of officials who failed to see far enough ahead to establish a thorough system of instruction and examination for their enginemen. Had this course been pursued, the careless and incompetent men could easily have been located and removed without wasting years in misplaced confidence. Later, when rush of business compelled wholesale promotions, some officials shut their eyes to plain facts and promoted men who passed a quasi-examination, but never made any effort to study the mechanism or management of a locomotive until the coming examination was announced.

If the large engines are to be a success, the needs of the enginemen must be considered, and they must be assisted in every way in the performance of their work. Periodical examination of firemen will give good timber to promote from. Coupled with these examinations there should be on every road a competent force of traveling engineers and firemen, masters of their business, thorough instructors and disciplinarians, with lots of patience to help those who show a disposition to help themselves. Many an indifferent engineman, with proper instruction and kind treatment will develop into a first-class runner and careful student of mechanics.

Superheaters for Locomotives.

In the admirable paper on Recent Improvements in Boiler Design, presented to the Railway Master Mechanics' Convention we find the following paragraph:

"Superheating of steam is attracting considerable attention abroad, particularly on the Prussian State Railways, where seventy engines are fitted with the Schmidt system of superheating. In addition to these the Schmidt principle is in use on the Alsace-Lorraine State Railways, the Belgian State Railways, the Moscow-Kasau Railway, the Southern Railway of Italy, and the Munich Suburban Railway. In this country the same superheating device is in use on the Canadian Pacific, and the American Locomotive Company is now constructing another engine similarly equipped for the same road. It is understood that there are also five of these engines under construction by the Pennsylvania road. Very glowing accounts of the performance of Schmidt engines, by an American en-

gineer who has recently returned from Europe, would imply that there were economy in superheating of steam for locomotives."

We believe that the introduction of an effective superheater would effect more economy on many of our locomotives than any form of improvement that could be applied; but it would not be equally efficient on all locomotives. There has been for several years an urgent demand for providing locomotives with immense heating surface, and this demand has too often been satisfied by sacrificing steam room. The boiler of a modern locomotive has to evaporate water so rapidly, that the ebullition inside must throw volumes of spray that under the most favorable condition mix with the outgoing steam; so it is easy to understand that a boiler with contracted steam space, passes through the dry pipe much aqueous vapor that has not been converted into steam. That vapor exercises a very pernicious influence on the real steam that passes into the steam chest, for it possesses enormous capacity for the absorption of heat and robs the steam of part of the heat of vaporization and chills the walls of the cylinder in robbing the metal of its heat. This intensifies the process of initial cylinder condensation, and revaporation at the end of the stroke, causing great loss of heat. Any superheating device which will convert the aqueous vapor into saturated steam is certain to effect economy and if it goes to the extent of superheating the steam all the better.

How to Learn Things.

We direct the attention of our readers to the article in another part of the paper on Training an Artist in the Forces of Nature, by E. H. Mullin, which was read at the convention of the American Institute of Electrical Engineers. We hear a great deal nowadays about the advantage of education, mental training, culture, etc., but very little concerning how the mental pabulum should be swallowed and no caution against overeating. Mr. Mullin favors plain mental food and comments very sensibly about turning attainments into proper channels. What will strike many people as a paradox are his words: "It is not the knowledge of facts which makes a man educated, but the possession of method. To teach a man to learn how to learn is the true function of education, and to stuff his mind with facts beyond this point is merely to encumber him in pursuing his means of livlihood." Although these expressions may sound strange to the unthinking, they touch a condition that imposes a woeful burden upon people who acquire a thirst for knowledge years after they have left school. They have not learned how to learn systematically, and too often, under advice, they proceed to stuff their mental stomach with facts, as Frenchmen stuff geese with food to produce *foie gras*, an abnormally fattened liver.

There is a genuinely earnest desire among thousands of people to acquire knowledge and there are many institutions trying to cater to the demand, but in the majority of cases the aid is not wisely given. It is easy to direct a student to pump information into his brain. The real teacher will instruct him how to assimilate and arrange the facts acquired so that they may be applied to useful purposes.

The paper appeals strongly to the writer, who wandered for years seeking knowledge in the wilderness, sent there by blind teachers, and kept there through lack of learning methods.

Motive Power Department Holds Up Its End.

In his admirable inaugural address to the American Railway Master Mechanics' Association President West, referring to the unparalleled rush of freight business, said that railroads which a few years ago employed a corps of freight solicitors had during the past year refused business through inability to handle it. "The press of the country have tried to pursuade the public that the trouble was with the motive power departments, or a lack of motive power or equipment; as a matter of fact, it was because nearly, if not quite all, the trunk lines lacked terminal facilities. It was no uncommon thing during the past winter to see miles and miles of trains, with the engine of the following trains within coupling distance of the leading train waiting for orders to move, and instances have been cited to me of train crews reporting for duty immediately on arrival of train at destination ready for work, having had the required amount of rest on the trip while sidetracked or awaiting orders. All these facts tend to prove that the freight congestion so much talked about was not due so much to lack of power and equipment as to operation or lack of terminal facilities. These conditions have proven more forcibly than could any committee of our association, had it continued its investigation of cost of running high speed trains, that the number of factors entering into the problem make it an unknown quantity, depending entirely on how much other traffic is delayed in keeping high speed trains on time, and unless they are kept on time it is no credit to the system attempting it."

The people who supply information that becomes press articles do not know enough about railroad operating to locate the cause of traffic congestion. They say what officials in the operative department tell them and that generally means reflection on the mechanical department.

This thing of trying to put upon the motive power department the blame for delay in moving traffic is an unfounded charge of very ancient origin. If a full supply of locomotives is not always ready when asked for by the operating department, complaints have been made that the power is not forthcoming when wanted, no matter how many engines are standing on sidings in the front of trains or blocked in yards. The operative department has always had the ear of the management and it is only human for these officials to shift blame from their own shoulders to that of their fellow officials responsible for keeping the motive power in train hauling order. It is beyond the memory of man to recall the beginning of the perennial complaint that the locomotives are not moving the number of cars they ought to do.

When cars were waiting to be moved and engines were found to be held in the round-house while necessary repairs were being done, or while enginemen were obtaining a few hours' sleep, people belonging to the operative department began working up the sentiment that it was senseless to keep engines waiting till human brains and bodies should rest. Locomotives needed no rest. Let another crew take the engine out, was the demand, and the pooling system was gradually brought into use.

Then a constantly recurring complaint was, the engines are not hauling the number of cars they ought to pull. As cars increased in capacity and weight, the operative department insisted on engines pulling the same number of loads until traffic became blocked with stalled trains. Then the tonnage rating was introduced and it is still with us without promoting harmony in a striking manner, or facilitating the movement of trains to a great extent. Tonnage rating ought to be just and equitable toward trainmen, toward the mechanical department and toward the operative department. Predictions were made that its general introduction would lead railroads to the starting point of Utopia, but it seems to have led many of them to the entrance of the region which genteel people now call Hades. No doubt there has always been a tendency among the motive power men toward light loading of engines, while the operative department tended to the opposite extreme. When an engine was rated to haul a certain number of cars over a division, the enginemen were aware of any attempt at overloading; under the tonnage rating system they have no means of knowing that they are overloaded until the distress of the engine and incidentally of the fireman tells it. Favoritism is by no means unknown in railroad business, and the complaint is common that screened by tonnage rating certain engines are habitually run light, while others are

constantly loaded with more than they can haul comfortably.

After the tonnage rating was introduced the next complaint heard was, the engines are not powerful enough. The fashion for increasing the size of locomotives became the rage, and railroad men are fiends for following a fashion. They have rushed after that craze until many locomotives have reached the limit that tunnels and bridges curtail them to, and the enormously large engines bid fair to be the worst elements for demoralizing train movement ever introduced. One influential class of railroad officials hold that the proper way to move cars promptly is to load engines with trains they can handle comfortably and push them at the highest speed which can safely be made; another set of officials believe in loading every engine down with every car it can haul, no matter how long the trains may be on the road. The latter class of men are those who demand more powerful engines, and their policy is responsible for the slow movement of trains.

Under the slow movement system the motive power department do not receive proper credit for the work done by the engines. They are credited with ton mileage, but they ought to have credit for the *hours* they are waiting in side tracks, or delayed on the road. When a report of performance tells the volume of work done by an engine it should add the number of hours it was idle while in steam on the road, otherwise there is no record of wasted work which in some cases amount to more than the useful work. We propose a new expression to measure the work done by locomotives—it is hour-mile-tons.

Honey's Magnetic Traction Increaser.

Several technical journals of late have had favorable comments on the Honey Magnetic Device and its probable application to steam and electric lines.

The device, briefly described, consists of a soft steel arm wound with copper wire. One end of the arm is secured to a band which encompasses the axle. The other end supports a small idler wheel which rides the rail when it is desired to put the device in action. Its object is to abolish the use of sand, to secure adhesion to the rail and increase the tractive effort by substituting magnetism. Under ordinary circumstances the idler wheel is held in suspense about one inch from the rail, but when, from any cause, the adhesion of the wheels to the rail is deficient, the idler wheel is lowered to the rail. This causes an electric current to flow from the arm to the car wheel or driver, and in its passage through the rail to the idler wheel, producing a short magnetic circuit.

It is claimed by the Magnetic Equipment Co. that tests made on an electric car at Seattle, Wash., developed a 300 per cent. increase in drawing capacity. A railroad official on one of our large trunk lines, and a probable stockholder with the Magnetic Co., ventures an opinion that it will enable a locomotive to pull four more cars with this equipment than without it. How he arrives at the number of cars or the class of engine he should use to pull these four extra cars, neither he nor they venture any enlightenment.

These species of claims are made by people interested in the invention. Efforts to use magnetism to increase the adhesion of driving wheels to rails have been made repeatedly, and they have always failed because it was found that increase of resistance to advance of the engine was always in proportion to the increase of adhesion due to magnetism. The Honey Magnetic Traction Increaser people appear to be devoted more to selling stock than to demonstrating by practical tests the value of their device. If they have got anything worthy to receive financial support they cannot too soon apply their invention to a full-sized locomotive and show what the engine can do hauling a train on a slippery rail. Meanwhile, we advise our readers to decline investing their hard-earned savings in the Traction Increaser Company's stock until they see the invention properly tried. This caution includes the employees of the Wabash Railway in and around Springfield, Ill.

Effects of Tonnage Ratings on the Cost of Transportation.

An individual paper, on the abovenamed subject, was read at the recent meeting of the Master Mechanics' Association by Mr. C. H. Quereau, superintendent of the Albany shops of the New York Central, he said:

The car was recognized as an unsatisfactory unit long before the ton was substituted for it. Even after the theoretical correctness of the ton had been fully admitted there was a quite general opposition to its adoption on the grounds that it would not work out in practice. Soon after its adoption, the discovery was made that the ratio between train weight and train resistance is not constant. This discovery lead to a scientific investigation of the matter with dynamometer cars, etc. These investigations revealed the fact that the greater gross weight per car, the less the resistance per ton and that the heavier the adverse grade and the slower the speed, the less this difference is. The next step was naturally in the direction of adjusted tonnage ratings, which increase the nominal weight of empty, partly loaded and low capacity cars in proportion to their resistance per ton, so that the adjusted ratings much more nearly approximate the resistance a train will develop than if the actual weights had been used.

The effect of this tonnage rating system has been to reduce transportation costs. The ton-mile basis for statistics logically followed the introduction of tonnage ratings. While the engine mile had been the basis of motive power statistics, the effort of master mechanics and engineers was to pull as light trains as possible, because an engine made more miles per ton of coal the lighter the train, and this fact no doubt tended to neutralize the efforts of the transportation department to handle heavy trains, and both departments working at cross purposes kept up the cost of moving cars. The advent of the ton-mile basis for motive power changed all this, and caused both departments to work together in harmony because it was found that, within reasonable limits, the heavier the train the less the cost of coal, wages and repair per ton-mile. Actual records show that the use of tonnage ratings increased the work done by the engines on a certain division by 24 per cent.

A table submitted by Mr. Quereau, based on the assumption that it takes an average of four hours to get an engine from its train to round house, clean its fire, give it necessary repairs, furnish supplies to it, and have it on its train again. Also on the assumption that a train of forty cars will allow an average speed of ten miles per hour. On the further assumption that a reduction of the train from 40 to 35.2 cars or twelve per cent., will permit an increase in average speed to fifteen miles an hour. This table showed that it was possible to get an increase of from 16 to 22 per cent. in the number of cars an engine will handle per month, due to a decrease of 12 per cent. in the number of cars handled per train, and that the longer the division the greater the increase.

Book Review.

Railway Legislation in the United States, by B. H. Meyer, Ph.D., Professor of Institutes of Commerce, University of Wisconsin. Publishers, The Macmillan Company, New York, 1903. Price, $1.25.

The aim of this book is to present a condensed analysis of the private and public laws which govern railways in the United States, and also to give the important decisions relating to interstate commerce. Several of the chapters have already appeared in the Annals of the American Academy of Political and Social Science and in the Political Science Quarterly.

The whole subject treated of here has been divided into three parts; the first is an introduction under which are discussed the significance of railways; characteristics of railway legislation in the

United States; foreign side lights, and economic adjustments. Part two, on the Progress of Railway Legislation, takes up early railway charters, later charters and early general laws, constitutional provisions and present general railway legislation. Part three deals with the past and future of the Interstate Commerce Commission, and discusses events preceding the act to regulate commerce, leading principles of the decisions of the commission, the Supreme Court and the Interstate Commerce Commission, and the Cullom bill. There are four chapters in the appendix, giving an American railway charter, articles of incorporation under general laws, the Massachusetts commission law, and the Interstate Commerce law. A supplement deals with the Elkins law and its interpretation. The book closes with an index.

Steam Turbines.

On another page will be found an abstract of a paper on A Steam Turbine, read by Mr. L. R. Pomeroy, at the Railway Master Mechanics' Convention. The steam turbine is so steadily pushing its way into favor with power users that the paper is very seasonable in giving railroad men information concerning a species of motive power that they may soon be called upon to employ. Those who use electric headlights are already beginning to have charge of the small turbine engines employed to drive the electric motors, and the indications are that electric machinery in repair shops, round houses and other places will soon be driven by steam turbines. We believe that the New York Central Railroad Company are arranging to install steam turbine engines to drive all the machinery at the West Albany shops, and other railroad cómpanies are negotiating for similar purposes.

The conspicuous advantage possessed by steam turbine over other forms of steam engines is its simplicity. The steam acts in the turbine as water acts on a water turbine, and not unlike the way that wind drives some forms of wind mills with many vanes. Strangely enough an elementary form of steam turbine was experimented with during the seventeenth century by the philosophers, whose efforts eventually led to the construction of the piston engine. In 1629 Giovanni Branca, an Italian, published the description of an engine, in which motion was produced by a jet of steam impinging upon the vanes of a horizontal wheel. The principal defect of that invention was the absence of appliances for making the steam follow the vanes until more of its energy was converted into useful work. If an ingenious engineer had devoted himself to improving the Branca invention, we do not believe that the reciprocating engine would have been forced into favor, as it was, by grim necessity.

The leading merits of the steam turbine as compared with the steam engine are: Small loss from friction of journals and other working parts; few movable pieces to get out of order; the capacity of being housed in very small space, and freedom from loss of heat by cylinder condensation. In a steam engine part of the steam is converted into work by the expanding steam pushing a piston; in steam turbines the work is done partly by the steam at high velocity propelling the vanes, partly by the expanding force of the steam. The principal steam turbines on the market are the De Laval, the Parsons, the Curtis and the Rateau. Recent improvements have made the steam turbine about as economical in the use of steam as the best reciprocating engines. The Westinghouse Electric Company, which make steam turbines under the Parsons patents, and the General Electric Company, which are making the Curtis steam turbine, are both installing many power plants, and are making serious inroads into the business formerly done by high class reciprocating engine builders.

Steam turbines seem to be peculiarly well adapted as power for steamers, since they do not occupy but a small fraction of the space occupied by ordinary marine engines. There are a few steam turbine steamers in use in Europe and two in the United States, but the owners of the large transatlantic steamers are slow about adopting the steam turbine. They probably are waiting for developments and to find out what kind of an *old* engine a steam turbine proves to be. Strangely enough we have not yet heard of the steam turbine being applied to a locomotive, but patents have been granted for that type of power to be applied to automobiles.

The Chicago, Rock Island and Pacific Railroad Company are building a huge locomtive repair shop near Moline, Ill. Mr. C. A. Seley, the mechanical engineer of the road, has made the designs for the works, and it is expected that they will be as perfect as anything built for locomotive repair purposes. Reports have been circulated that the shops were intended for the construction of new engines, and that the Rock Island system intended to build all its rolling stock as soon as the facilities were provided, but we have the best of reasons for believing that such reports are not correct. There will be enough repair work sent in from the lines in Illinois, Iowa and Missouri to keep their large works fully occupied.

There is no playing fast and loose with the truth, in any game without growing the worse for it.—*Little Dorrit.*

QUESTIONS ANSWERED.

(50) R. L. S., Sarnia Tunnel, asks:

Why can more weight be obtained on the drivers than on the leaders or trailers when the spring gear is connected by means of equalizers? A.—The spring gear is connected by equalizers to two or more wheels as the case may be, and the reason one wheel may carry more weight than another with which it is "equalized" is that the whole equalizing gear is not sufficiently sensitive to adjust weights closely. Many driving springs stand on the full flat underside of the buckles, and though the hangers and equalizers are pivoted they are comparatively rough and are never lubricated. The whole arrangement, however, does very well because there is no object in producing so very close adjustment. If you examine a track scales you will see the pivot points and knife edges of hard steel finely finished and protected from dust and dirt, and giving practically perfect ajustment. By making a mental comparison between track scales and locomotive spring rigging you will get an idea of their relative value as equalizers.

(51) J. R. and Others, Truro, N. S, write:

(1) Some years ago "Balanced Compound No. 1," with four cylinders, cranks set at 180 degs., with small trailer under firebox and Mother Hubbard cab, was tested at Perdue and ran very smoothly, the wire coming from under the drivers like a ribbon. We have heard nothing of it since. A.—The even ribbon-like appearance of the wire as it came from under the drivers showed that the engine was well balanced. If the wire had been very flat in places and only slightly flat in others, it would have been evidence of uneven balance. The engine left Perdue University after the test, and was taken to Altoona, where for a year or more it was more or less used for experimental work on the Pennsylvania Railroad. (2) Not long ago an engine of similar type was built at the Baldwin Works for the Plant System. It was the 20,000 engine built at Baldwin's. Can you tell something of the performance of this engine? A.—The engine is now running on the Wheeling and Lake Erie Railroad, where it is doing excellent work in freight service. (3) We have been told that the Baldwin's are experimenting with an apparatus to admit live steam to the cylinders, but without its escaping from the exhaust. In other words to make the cylinder for the time being a part of the boiler, probably with an intercepting reducing valve. What can you tell us concerning this? A.—You have probably heard something of the drifting throttle recently patented by Mr. Kenneth Rushton, of the Baldwin Locomotive Works. This throttle is designed

to allow a small amount of steam to enter the steam pipes when the engine is drifting, in order to convey the lubricant to the cylinders. We have illustrated this throttle in another column of this issue, headed "The Rushton Drifting Throttle," page 358.

(52) J. G., Muskegon, Mich., asks:

How many railroads in the United States have a trench in the track from which their engines take water without stopping? A.—We have no statistics before us on this subject, but we may say that track tanks are used on the New York Central, the Lake Shore & Michigan Southern, the Philadelphia & Reading, the Central Railroad of New Jersey, the Pennsylvania, the Chicago, Milwaukee & St. Paul, the New York, New Haven & Hartford, the Baltimore & Ohio, and the Michigan Central Railroads.

(53) G. D., Evansville, Ind., writes:

Please explain to me how to lay the keyways for eccentrics with wooden straight edge before setting the valves, and if there is another way to lay off eccentric keyways which may be better than that with the wooden straight edge? A.—We do not understand exactly what you mean, but the usual way to find the position of the keyways on locomotive axles is to put the eccentrics on, having the keyways already cut in them. Secure the eccentrics to the axle by means of the set screws, then set the valves, and mark off the keyway in the axle from the keyway in each eccentric.

(54) I. M. S., Biwabik, Minn., asks:

How to calculate the tractive power of a compound locomotive? A.—The formula used for a two-cylinder compound is

$$\frac{C^2 \times S \times \frac{2}{3} P}{D} = T$$

The formula for a four-cylinder compound is

$$\frac{C^2 \times S \times \frac{2}{3} P}{D} + \frac{C^2 \times S \times \frac{1}{4} P}{D} = T$$

Where T is the tractive power in pounds, C is the diameter of the cylinder and S the stroke, both in inches, P is the boiler pressure in pounds and D is the diameter of the driving wheels in inches.

(55) G. W. D., Columbus, O., writes:

I am firing a 10-wheel Brooks on a fast run that is causing me much trouble. Two weeks ago the steam pipes on this engine were found leaking and were ground in. On her first trip out after this work was done she steamed for twenty-five minutes and quit. Since then the foreman tells me that if I fired her right she would steam. I claim she has leaky steam pipes again, and am ridiculed for it. What is the trouble? A.—From your description, if the draft plate is in its proper place, you may have either leaky steam pipes or exhaust stand, possibly both. With bottom joint on steam pipes or exhaust stand joint leaking, there is always excessive heat at the fire-door. Go out on the running-board and watch the cylinder saddles when engine is working steam. No doubt they are working and shearing the saddle-bolts, and have loosened the steam pipes again.

(56) C. V. D., Chicago, writes:

(1) Are there any engines in use with the eccentrics on the forward axle and the main rod connected to the second or main driver? A.—Yes, some of the western lines have them yet. A modern example will be found in the Baldwin engine illustrated in this issue on page 371. (2) If such an engine breaks the forward side-rod is it safe to run the engine with the rod on the opposite side up? A.—Yes. If you should attempt to move the good side with the rod down there would be danger of slipping the main drivers, and the result would be a rupture of cylinders or destruction of running gear. An engine in that condition should never attempt to bring in a train. See article, Hints on Break Downs, page 283, June issue.

(57) F. B. M., Louisville, Ky., writes:

I am a fireman with three years' experience and in line for promotion. If the examiner should ask the following questions how should I answer? (1) Suppose you broke the left forward cylinder head and the right back-up eccentric, what would you do? and (2) Suppose you broke the right piston rod and the left go-ahead eccentric strap, what would you do? A.—Your answer to the first question should be: Take off head on right cylinder and put it on left. Leave main rod, right side up, to help me off dead center in case I stopped on dead center left side. Then disconnect right valve stem, cover port and clamp stem. (2) Cover port on right side, leave up main rod, take down both eccentric straps on right side and replace the broken strap with one of them. In both cases, I would try to bring in part of a train with the engine.

Heaviest Car in the World.

Our half-tone illustration shows what is probably the heaviest car of its kind in the world. It is, of course, a special car built for a special purpose, like the steel flat car used in connection with heavy gun which we illustrated in our January issue. The Bethlehem car measures 64 ft. between king pins, it is 9 ft. 9 in. wide and is 10 ft. 2¼ in. high. The length over couplers is 103 ft. 10½ in.

This car itself is practically a bridge truss, 6 ft. high in the center and 66 ft. 10 ins. long over all. This is carried upon two trucks, each containing 8 axles. The capacity of the car is 300,000 pounds, and when fully loaded this gives an axle load of 18,750 pounds. The trucks are about 38 ft. long. The axle boxes work in jaws and upon the top of each box rests a heavy semi-eliptic spring, all the springs being equalized together. The light weight of the car is 196,420 pounds.

The car was made by the Bethlehem Steel Company for their own use, and has already borne the weight of two iron castings the combined weight of which was 277,000 pounds. There are also several other castings, made of steel by this company for the 1,200-ton forging press for the Carnegie Steel Company, which are in all likelihood the largest steel-castings in the world. The amount of metal necessary to make one of these castings being about 325,000 pounds. This requires six 40-ton open-hearth furnaces running full blast to provide the required metal for each such casting.

HEAVIEST STEEL CAR IN THE WORLD.

"It ain't our station in life that changes us—thoughts is free!"

—Little Dorrit.

Air-Brake Department.

CONDUCTED BY F. M. NELLIS.

Operating Conditions of High-Speed Trains.

The advantage gained by the use of Westinghouse high-speed brake apparatus is, in general, sufficiently emphasized by the bare statement of superior efficiency; but, to appreciate the reasons that have led many of the leading railways of the country to adopt it as the standard for trains running at high average rates of speed, it is necessary to keep in view the special circumstances under which such trains are operated. While many local trains frequently run at very high speeds for comparatively short distances in convenient places, this occurs under conditions that involve no unusual risks. The chief characteristic of the special train service here considered is not so much the maximum speed attained as its high average rate between terminals, which required a velocity through yards and over bridges, switches and crossings (where ordinary trains are required to be under full control) not heretofore demanded and consequently not provided for.

Signals have already been located at such distance from danger points as to provide ample space in which to bring trains to a stop from customary speeds; but they are sufficiently near such points to avoid interference with the orderly movement of trains through unnecessarily retarding their progress at remote distances. The distance between block signals, upon roads subject to heavy traffic, has been likewise established upon these principles. The introduction of a train service in which the speed is considerably greater than that for which the operating conditions of the road have been established, is accompanied by complications of greater gravity than would readily be anticipated. The distance in which a train can be stopped from a speed of forty miles per hour is nearly twice as great as that from which it can be stopped from a speed of thirty miles per hour. At fifty miles per hour, the stopping distance is more than three times as great as that required at thirty miles per hour, and nearly twice as great as that required at forty miles per hour. At sixty miles per hour the distance required for stopping is about five times as great as that required for thirty miles per hour, and more than two and one-half times as great as that required at forty miles per hour. In addition, the frequency of meeting danger signals—and therefore the frequency with which applications of the brakes are likely to occur—increases directly with the speed. It is therefore important that unusually frequent applications of the brakes shall be provided for, without seriously impairing their capacity to stop the train in the shortest possible distance at any instant that emergency demands it.

The safe operation of such trains requires either a reorganization of existing signal systems or more effective means for controlling speed by the brakes than have heretofore existed. The objections to materially increasing the distance between signals and the points which they protect, or introducing additional signals for the special protection of such fast trains, are many and obvious; and a satisfactory solution of the problem seems to be found only in providing high-speed trains with a brake apparatus of extraordinary efficiency to meet the requirements of the special conditions, and in a manner that will enable such trains to be operated with the same degree of safety as is now common with ordinary trains, in so far as the controlling of speed by power brakes is concerned.

The most scientific and efficient way of stopping trains is by the automatic regulation of brake-shoe pressure, beginning with comparatively heavy pressure at high speeds, and reducing the same relatively as the speed slackens. This is exactly the method employed in the use of the Westinghouse high-speed brake.

This brake, which consists of the Standard Westinghouse Quick-Action Brake with a pressure-regulating attachment, was originally designed to meet the exceptional requirements of trains scheduled at the high average rates of speed now so common in regular service. The most gratifying results following the extended use of this device has been the demonstration of its absolute reliability, the quality which, above all others, is requisite in brake apparatus. The Westinghouse High-Speed Brake will stop a properly equipped train in about 30 per cent. less distance than that required for stopping a similar train under the same conditions with the best braking appliances in use before the high-speed brake was introduced.

This superior stopping capacity is obtained in part by increasing the air pressure, from the usual 70 lbs. to about 110 lbs. An additional advantage is that an ordinary quick-action brake may be converted into a high-speed brake without difficulty and at slight expense.

OFFICES AND FACTORY WORKS OF THE WESTINGHOUSE AIR BRAKE COMPANY AT ST. PETERSBURG, RUSSIA.

Ingenious Compressed Air Tools.

At the New York, Susquehanna & Western Railroad shops, at Stroudsburg, Pa., there are some very handy and efficient appliances operated by compressed air, several of which are herewith illustrated by permission of Mr. W. H. Taylor, M. M., who was assisted by the general foreman, Mr. M. N. Diefenderfer, and Mr. T. Y. Mellin, in working out the details of these tools.

THE WESTINGHOUSE AIR BRAKE COMPANY'S OFFICES AND WORKS AT HAMILTON, ONTARIO, CANADA.

Fig. 1 shows an ingenious device attached to the throttle valve of a stationary engine, for instantly stopping the engine in case of danger to life or machinery. A cylinder 1¾-in. diameter by 12-in. long is placed below and at one side of the throttle valve stem. The top head of this cylinder has a square hole, through which passes a 1-in. square piston rod, having teeth cut on the side

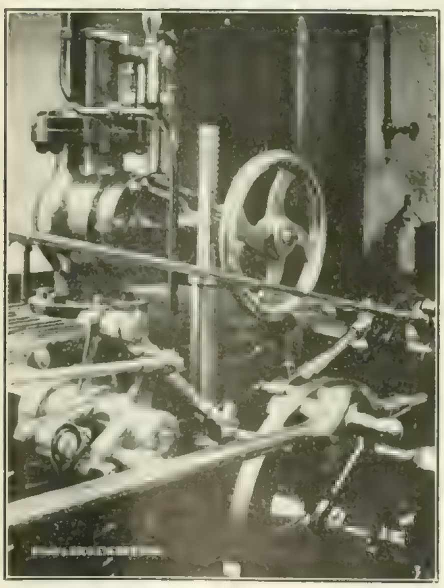


FIG. 1. THROTTLE VALVE OPERATED BY AIR PRESSURE.

next to the throttle stem. These teeth engage a 4-in. gear wheel keyed on the stem, and permits throttle to be opened nearly one turn. At convenient points in the different departments a ⅜-in. cock is placed, which, when opened, admits air to the bottom of the cylinder, pushing the piston and rod upward, thereby closing the throttle and at the same time sounding a warning whistle. A small bleed cock is placed below the cylinder to allow the throttle to be opened at once if desired.

Fig. 2 is an improvement added to the ordinary lever handle pump (1) for testing gauges, and consists of an air cylinder (2) 3-in. diameter by 6-in. stroke, and a water cylinder (3) 1½ in. diameter by 6-in. stroke, place above it, the piston rod from the lower cylinder passing up and connecting to the plunger in the water cylinder. Air is admitted by means of a 3 way cock (4), having a 1-32-in. port, to under side of the lower piston and forces it upward, thereby compressing the water above the plunger in the upper cylinder and creating sufficient pressure to test any gauge in ordinary use, a small coil spring is attached to the piston rod, drawing it back to normal position when air pressure is released. This makes a very neat and convenient arrangement, is very steady in its action and does not interfere with use of lever handle pump when air pressure is down.

Figs. 3 and 4 are views of an air pump repair stand which is simple in construction, very rigid and easily handled. Fig. 3 shows the table in position to receive the pump, which is bolted to lugs, and when the 3 way cock at the base is opened, the air forces the piston up, and, as the table rises, a small rod attached to the floor and the top of the table pulls the table to a horizontal position (Fig. 4), where it can be turned in any position or fastened at the will of the operator. The skeleton frame of the table makes any part of the pump easy of access, and is constructed to hold both 8-in. and 9½-in. pumps.

Fig. 5 is a boiler test pump, the upper parts of which consist of a steam cylinder, top head and center piece of an 8-in. air pump. The lower or water cylinder (2) is made from 3-in. galvanized pipe, reinforced at the ends by shrinking on a 1½-in. by 2-in. band. The piston rod is 1½-in. longer than the standard 8-in. pump rod, and a stop piece 1½-in. long is placed on under side of the top head of the water cylinder to prevent the plunger covering the inlet port on the up stroke. The supply is at 3 and delivery at 4, the check valves being placed in front as shown. The pump is mounted on a special truck which makes it very convenient to handle, and it does the work in a very satisfactory manner.

Train Pipe Leakage.

The increasing use of air brakes in freight service is developing certain difficulties of operation and maintenance that have required considerable experience to reveal and which should be remedied, as they are greatly reducing the efficiency of the brake service that is obtainable if certain conditions can be controlled. The principal manifestation of an unsatisfactory state is the large number of instances in which but few of the whole number of brakes in a train are connected. This is a most objectionable practice and so contrary to the ideas that led to the application of brakes to freight trains, that careful inquiry has been made to ascertain why the practice is so general. The result of this investigation shows that several reasons of more or less importance combine to account for it, but the chief causes are few in number and at the head of the list is *train pipe leakage*.

If this leakage is of any considerable degree the pump is overtaxed, with abnormal wear and tear, and brakes are

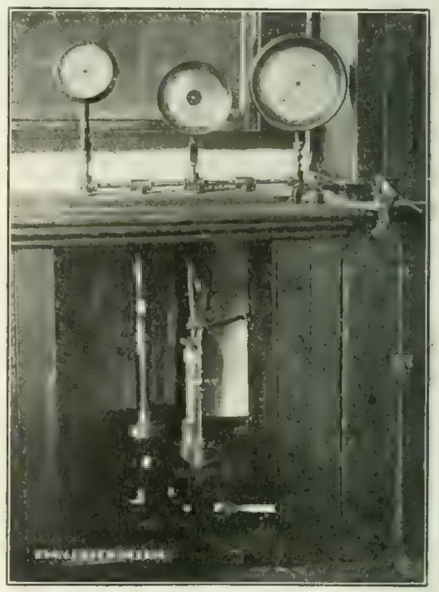


FIG. 2. AIR PRESSURE DEVICE FOR TESTING AIR GAUGES.

cut out of service until the pump capacity is sufficient to keep a working pressure. It also interferes with graduated brake application on level track and is almost fatal to safe working on down grades, for when communication with the main reservoir is cut off, leakage acts in one

respect as an engineer's valve in that train pipe pressure is reduced and the brakes are applied, but without manipulation on the part of the engineer. As the leak is out of his control, the appli-

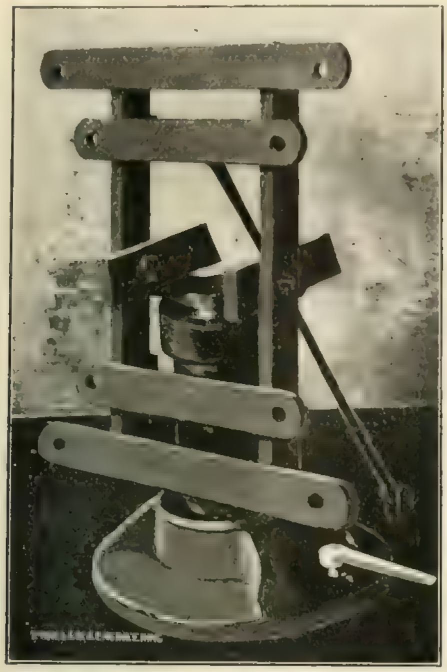


FIG. 3. AIR PUMP REPAIR STAND OPERATED BY AIR PRESSURE.

cation continues until the brakes are fully set, even though only a moderate force is needed or desired. It is therefore evident that train pipe leakage not only limits the number of brakes that can be used, but also seriously interferes with the proper and normal actuation of those that are in service. As intimated above, it is one of the principal causes for excessive air pump repairs.

The principal source of leakage is from defective hose coupling gaskets that have been injured by the practice of pulling the couplings apart when cars are separated, instead of uncoupling them by hand. While the construction of the coupling is such that this can be done without injuring the hose, yet a continuance of the practice destroys the gasket. It appears to be conceded that it is practically impossible to get trainmen to disconnect couplings by hand, and the remedy seems to be the substitution of a coupling that can be pulled apart when cars are uncoupled without in any way affecting its capability for making an air-tight joint.

This object is fully attained with the Westinghouse automatic coupler, which also facilitated the making up of trains and insures the use of brakes in many cases where now there is a disposition to couple up just enough to meet the requirements of the situation as measured by the ideas of the trainmen. A train partially fitted with air brakes has elements of danger that are to be avoided as far as possible, and anything that will automatically tend to assure the operation of all the brakes on the train is in the right direction. There is no other single modification that would contribute to the desired result more than the use of a good automatic hose coupler. When all the cars in trains are fitted with operating brakes, the disastrous results of parted trains will almost entirely disappear, and until this is done one of the greatest benefits to be derived from their use will not be realized.

CORRESPONDENCE.

Economical Repairs to 9 1-2 Inch Air Pumps.

In order to give what we considered the best practice for repairs to the 9½ inch air pump an accurate account of both labor and material was kept to ascertain definitely the most economical way of doing the work creditably, and we have found that the following is the best.

The practice of partially overhauling pumps on engines should only be indulged in to a very limited and unavoidable extent. It has been found a much more economical and reliable practice to remove the pump from the engine and give it a thorough overhauling in the air-brake repair room, than to attempt

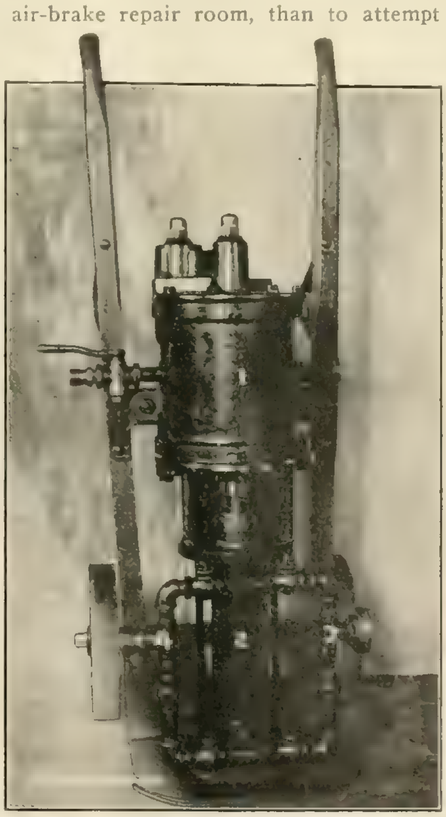


FIG. 5. BOILER TEST PUMP.

to repair it on the engine in the round house.

We have adopted the plan of overhauling air pumps at our general shop. This eliminates improper repairs being made at the smaller, outlying places, and the carrying of extra stock at those points for making repairs, which is one of the greatest expenses attached to a railroad company. It can be readily seen that the

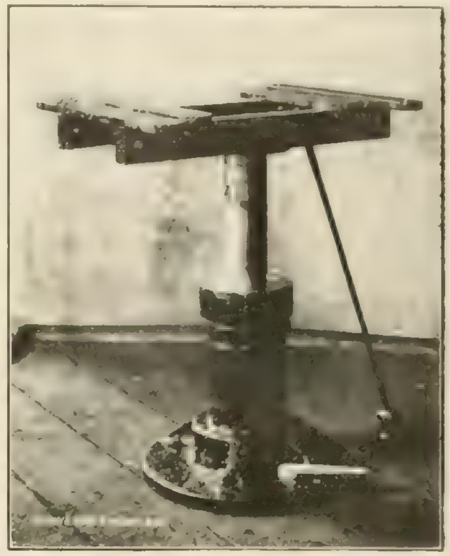


FIG. 4. AIR PUMP REPAIR STAND IN HORIZONTAL POSITION.

repairs to air pumps will be much more satisfactory and economical when done at a general, centralized point, and under the direct supervision of a competent and thorough air-brake man. There are two very important factors we must bear in mind; first, "Workmanship;" second, "Standards." Only such men who have proved themselves competent and who have been thoroughly instructed by the general air-brake inspector, should be employed on repairs to air pumps. Standard sizes and parts should be adhered to as much as possible.

Air pumps should first be put into a vat or tank containing a strong solution of lye, and allowed to soak until all grease and dirt have been removed. Steam should not be admitted direct into the vat, as with this method the solution is rapidly diluted. A coil with a drain should be used. The pump should be removed from the vat and thoroughly blown out with steam until all ports and passages are perfectly clear. This work should be done by a helper. The pump should then be turned over to the air-pump repairman, and should be thoroughly dismantled.

The practice of scrapping main valve bush No. 75, and applying a new one instead, is an extravagance, to say the least. The main valve bush should be pressed out of the head, put in a lathe, and bored to $3\frac{5}{16}$ of an inch, after which a bushing should be turned to fit the main valve bush that has been bored, and should be forced in, bored to standard size and properly faced, ports to be drilled through the new bushing. The bush is now ready to be pressed back

into the head. This work can be done for 85 cents, and against $4.75 for a new bush is a saving of $3.90.

The left main valve cylinder head should be placed in a lathe and bored to $2\frac{3}{8}$ of an inch, after which a bushing should be turned and pressed into the head, bored and faced to standard size, and ports properly drilled. This work can be done for 40 cents, and against 75 cents for a new head, is a saving of 35 cents.

The large and small main valve piston packing rings, Nos. 78 and 80, should be removed and new ones applied and properly fitted. Our experience has been that home-made rings do not give the proper wear and life that rings furnished by the Westinghouse Air-Brake Company do.

The main slide valve and its seat should be properly faced. When the main slide valve has $\frac{3}{64}$ of an inch play between shoulders of the main valve stem, it should be scrapped and a new valve applied.

Next remove the reversing valve chamber bush, No. 73, and apply a new one. Also apply a new reversing valve No. 72. We have found that when bush is renewed an old reversing valve should never applied.

Three sixty-fourths of an inch play between valve No. 72 and reversing valve rod, when valve is new, calls for a new rod; however, templets should be used to ascertain which part is worn and needs renewing.

It should also be noted that the reversing valve chamber cap is properly fitted on bush No. 73 and on the head proper.

Care should be taken that the distance between the knob on the end of the reversing valve rod and shoulder is of the proper length, the reversing valve plate should be removed to ascertain the exact condition of the under side. If worn on either side, apply a new plate.

Steam piston and rod No. 65 should be examined, and it is quite essential, that the rod be perfectly true. New piston packing rings should be applied. Great care should be taken in the workmanship in applying rings, otherwise the pump will blow, and back pressure will be materially increased.

When a packing ring is cut, that portion of it nearest the ends has a tendency to remain straight. When the ring is reduced to the size of the cylinder, the result is a poor fit for almost one-third of the circumference. To obviate this trouble and thereby secure better fitting rings, it is necessary to either file off the outside of the rings nears the ends, or turn them up in a lathe after the rings have been cut. Either plan will do, just so the rings are made to fit the cylinder properly. The same is applicable to the air cylinder piston packing rings.

In applying piston No. 66 it is desirable that lock nuts should be used on the end of the piston rod, as furnished by the Coffin-Megeath Supply Company, Franklin, Pa.

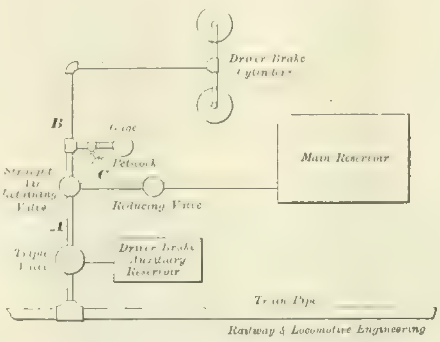
It is the most advisable and most economical way, when necessary to bore steam and air cylinders, to bore them to a standard of $9\frac{5}{8}$ of an inch and apply new pistons and rods.

The centerpiece needs more than passing notice. If the piston rod has been turned down in order to true it up, new glands should be applied, and as close a fit on piston rod without binding.

Stuffing box nuts should fit neatly, and the box itself should be carefully examined to see that it is properly secured and tightened in the centerpiece. Air valve seat No. 87 and valve cage No. 88, when worn, should be removed and new ones applied; also new air valve No. 86. Care should be taken that the lift of the air valves does not exceed $\frac{3}{32}$ of an inch.

It is not advisable nor practicable to use new air valves with old valve cages or valve seats unless seats are properly trued. All copper joints should be annealed.

All repaired pumps should be put on a test rack and run a sufficient length of time to assure their efficiency before being placed in active service.



DESOE'S RETAINING DEVICE.

By following the above recommended practice of repairs, the failure of air pumps on our line of road has been reduced to a minimum. For the year ending June 1, '03, there were but three air pump failures, which were reported as follows: "Reversing rod broke." "Main piston rod broke." "Reversing plate bolt worked out."

OTTO BEST, Gen'l Air-Brake Inspr.
N. C. & St. L. Ry.
Nashville, Tenn.

Retarding Power of Driving Brakes.

(Continued.)

The trouble experienced with this arrangement was the unsatisfactory operation of the safety valve, and not being able to admit air from the main reservoir to the cylinders before the triple was moved to release position. The latter trouble was overcome in a way by a pipe connection between the pipe connecting the gauge to the cylinder, and the pipe connecting the valve with the exhaust port of the triple, in which a globe valve was placed, so that when it was desired to admit air from the main reservoir to the cylinders with the triple in application position, the handle of the retaining valve was placed in the proper position and the globe valve opened. This, however, made the arrangement complicated, and the safety valve was very unsatisfactory, so the entire arrangement was discarded.

The next arrangement, which is illustrated by the accompanying sketch, proved to be much better than any tried, and is in use on a number of engines today. It consists of a three-way valve, located in the cab. One opening is connected to a train air signal reducing valve (Pipe "C" in the sketch), which, being adjusted to 40 pounds pressure, reduces the main reservoir pressure admitted to the brake cylinders to 40 pounds. One of the other openings is connected to the pipe leading from the triple to the brake cylinders (Pipe "A" in the sketch), and the third opening is connected to the pipe from the brake cylinders (Pipe "B" in the sketch). That is, the pipe connecting the triple with the brake cylinders is extended up into the cab, where it is cut and the retaining valve inserted. In one position of the handle of the retaining valve the automatic brake can be applied and released just the same as it can when piped as ordinarily, for pipes "A" and "B" are connected through the retaining valve and pipe "C" is blanked. With the handle of the valve in retaining position, communication from the triple to the cylinders is closed, and communication is established between the reducing valve and the brake cylinders; that is, pipes "C" and "B" are connected and pipe "A" is blanked, therefore, in this position 40 pounds pressure is assured in the cylinders, with any ordinary leakage, whether the triple is in application or release position. There is a lap position to the valve so that any portion of the 40 pounds may be admitted to the cylinders.

A gauge is connected directly to one of the cylinders, so that the pressure developed may be known at any time. This arrangement works very satisfactory, but some trouble is experienced by the plug-cock leaking, and I am having made a valve in which leather seat popet valves will be used, and I expect to use with this valve a slide-valve reducing-valve. I see no reason why the Westinghouse Air Brake Co.'s "Straight Air Automatic Brake" would not fill every requirement of a straight air retaining valve, which I term the valve described.

E. G. DESOE, Gen'l. A. B. Inspt.
B. & A. R. R.
Springfield, Mass.

QUESTIONS AND ANSWERS

ON THE AIR BRAKE

(57) B. J. S., Frankfort, Ind., asks:

Does the friction of the air passing by a leaky packing ring in the air end of an air pump cause the pump to heat? A.—The greater amount of heating is due to compression, during which process the molecules of air are forced against each other harder as the pressure increases, thus causing friction between the molecules and consequent heat. The mere passing of air by the packing ring from one end of the cylinder to the other does produce a certain amount of friction, doubtless, but not very much, perhaps about the same amount that would be produced by air passing through a pipe in which the pressure does not vary much.

(58) J. W. E., Pittsburg, Pa., asks:

Why does a cylinder wear larger on the ends than it does in the middle? This applies both to air and steam cylinders of the air pump. A.—Because the pressure at the end of the stroke is higher than at the beginning. This pressure gets behind the packing rings and forces them more tightly against the walls of the cylinder as the stroke progresses, the greater pressure being at the extreme end of the stroke. Thus the greatest wear is had where the pressure is highest. On the return stroke this same is true. The steam cylinder does not wear as much larger at the ends of the stroke as does the air cylinder, but wears irregularly at all points of the stroke, and has a great tendency to wear out of round.

(59) B. F. R., Camden, N. J., asks:

Would the friction of the air passing through a crack in a leaky discharge pipe cause the pump to heat? A.—The air passing through the crack would not heat due to the friction caused between the air and the edges of the crank through which the pressure is passing, as the pressure, in escaping at the crack, would reduce and cool. The pump, however, would be required to do more work to keep up this leakage. The greater heat, due to greater amount of air compressed, would cause the pump to run hotter than though the crack did not exist and did not have to be supplied. In other words, it is the friction of the air molecules rubbing together that causes heat, more than the mere rubbing of the air against the sides of the piston and walls of the cylinder.

(60) J. W. E., Pittsburg, Pa., writes:

What would you think was the trouble if an air cylinder that has been properly oiled and had packing rings perfectly fitted, and in fact everything in perfect working order, if, upon examination, it is found to have the inside of the cylinder cut? A.—If the cylinder walls and packing rings are always lubricated, and foreign matter excluded from the cylinder, there will be no cutting. However, the present method of lubricating the air cylinder gives it a flood of oil at some times and a dearth of supply at other times. This permits the parts to get dry, and friction of the dry parts causes cutting and scoring of the cylinder walls and packing rings. On long trains in freight service it is seldom that the air cylinder is kept constantly and uniformly lubricated, and this cutting, due to dry surfaces and entrance of sand, cinders and other foreign matters into the cylinder through the suction, causes cutting of the parts.

(61) A. M. E., Frankfort, Ind., writes:

A number of the truck wheels on our engines which have steel tired wheels are troubled with flat spots. The spots do not seem to come from the wheels skidding on the rail, as there are no brakes on these wheels to skid them. A.—Doubtless you are experiencing a trouble similar to that had on some of the Atlantic type trailing wheels, although these are braked. This trouble is had from flat spots, at first believed to be due to too much brake power, but which is really due to "faults" in the tire material. A number of these tires have been found to have "blow holes" or "faults" in the tire. When this "blow hole" comes in contact with the rail, the metal around it closes in to fill up the "blow hole" or shelled out place, causing the metal to recede from its original position, thereby creating a flat spot. In the event of the "blow hole" being found in the middle of a flat spot, it would seem proof conclusive that the flat spot comes from the "blow hole" and not from the skidding of the wheel.

(62) C. A. K., Jamaica, Long Island, N. Y., writes:

We have a case of a three-car train sliding wheels with 50 pounds train line pressure. We find it impossible to carry 70 pounds train line pressure, because of wheel sliding. A.—Doubtless this trouble comes from poor brakes on the locomotive and tender. In cutting down the train line pressure to 50 pounds you would undoubtedly get away from the sliding of wheels on the cars, except in extreme cases of bad rail, etc., but at the same time one puts himself in a very undesirable position in doing this by so weakening the braking power of his train that he cannot make a quick stop if he should be required to do so. We should certainly advise putting the train pipe pressure up to 70 pounds. Put a gauge on the driver brake cylinders of the locomotive and also one on the tender brake cylinder, then apply the brakes and note whether the pressure holds in the cylinder or whether it leaks off quickly. We think you will find your trouble from wheel sliding on the cars due to poor leather packing in the driver brake cylinders or tender cylinder.

(63) W. J. J., Little Rock, Ark., writes:

We have an 8-in. pump here that will make an up stroke and down stroke quite regular when the pump first starts to pump up air, and until it gets up to about 40 pounds. Then its down strokes are much quicker than the up strokes. The higher this pump pumps pressure, the quicker are the down strokes and the slower are the up strokes. We have looked for the trouble everywhere and find the pump in good condition. A.—There is doubtless dirt or other foreign matter under the upper discharge valve of the air cylinder of the pump which you have failed to note. Possibly there is either a flaw in the upper discharge valve or its seat, causing it to let pressure pass from the main reservoir to the air cylinder of the pump when the valve is seated. When the pump is first started this fault would be little noticed, because the pressure is not very high; but as the pressure increases the fault will become more noticeable, and the downward stroke would be made quicker, due to the leakage of pressure from the main reservoir back into the air pump through the upper discharge valve, due to the dirt between the valve and the seat or to the fault in the valve or its seat.

(64) L. R. M., Trenton, N. J., writes:

On some of our high-speed trains when the brake is applied in service application position, with a three-car train, and sometimes with a ten-car train, the brake will go on in quick action when not wanted. A.—Your trouble on the short train is probably due to the fact that the equalizing piston perhaps hangs back, and when it does rise it rises too quickly and discharges train pipe air to the atmosphere too suddenly when the service application is made. The equalizing piston may be dirty, causing it to move with a tardy or jerky movement, thus squirting the air out of the train pipe in jerks, which so affects the triple valves as to throw them into quick action. Possibly the triple valves themselves are dirty and need cleaning. In either event we would examine both the triple valves and the equalizing piston of the brake valve. This same trouble has been experienced on other roads, and after careful investigation of the triple valve and brake valve conditions, it has been decided to put on an equalizing reservoir 10x14 in., in place of the present one of 10x12 in. The 10x14 in. reservoir is now the standard of the Westinghouse Air Brake Co., and is being sent out on all orders.

"You'll be switched if you don't keep to the right," as the flagman said to the train on the single track.

Sheedy Circulator for Locomotive Cylinders.

On page 275 of our June number we illustrated locomotive 2279, a piston valve engine belonging to the Southern Pacific Company, which is equipped with the Sheedy patent circulator for relieving cylinders of back pressure and vacuum. Annexed we present some indicator diagrams to illustrate the effect of the invention and the conditions that exist in the cylinders when the circulator is not in use.

As many of our readers do not understand indicator diagrams the following explanation will be helpful. The horizontal line shown in all the diagrams is called the atmospheric line, and indicates the division between pressure and vacuum. The lines which the indicator pencil draw above the atmospheric line indicate pressure in the cylinders, the lines below the atmospheric line indicate vacuum. A spring of 30 pounds resistance was used in the indicator, so the pressure or vacuum is calculated by the height or depth of the diagram from the atmospheric line.

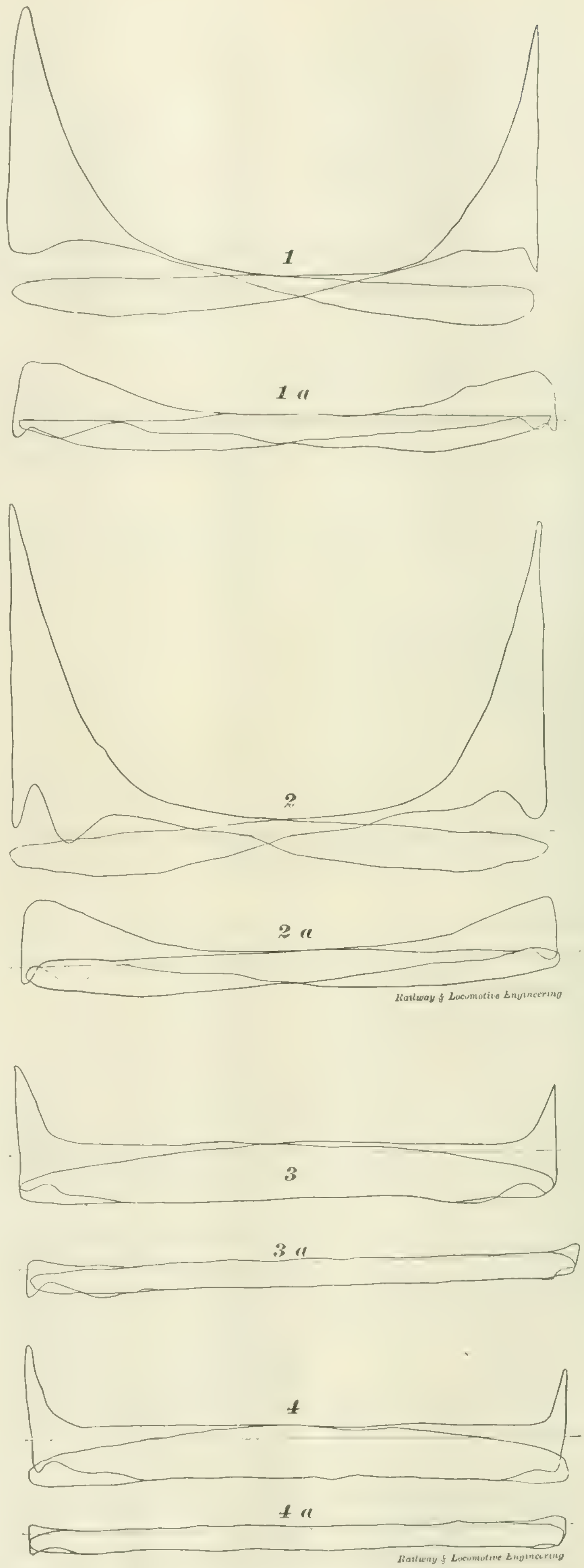
The cards 1 and 2 were taken when the engine was running with the reverse lever in the 10 cut-off notch with the circulating pipe cut out. Cards 1a and 2a were taken in the same notch with the circulating pipe in operation. We have put these cards in pairs to show the great beneficial difference when the pipe is doing its work. Cards 3 and 3a, 4 and 4a represent the engine running with the lever in the 22-inch cut-off notch. The pressure shown in the cylinders, which goes as high as 45 pounds to the square inch when running at 10-inch cut-off with the circulating pipe cut out, acts as compression or back pressure and resists the movement of the piston. The vacuum also resists the motion of the piston and sucks dirt into the cylinders.

Diagrams show the result of indicator tests. This engine has been shopped recently for general repairs. An examination of the piston valves shows them to be in perfect order with no noticeable indication of wear and outside of the cost of examination there has been no expense connected with their use since they have been put in service.

This circulator is also used on low pressure cylinder of compound engines.

The device is absolutely automatic in its operation. Whenever steam is applied to move the engine, the valves are bound to close and cut off the communication between the front and back of the cylinders. Whenever the steam is shut off by the closing of the main throttle, the circulator valves open without fail.

Its application to a single expansion piston valve engine brings the compression line just where you want it. In the case of engine 2279 the circulator takes



SHEEDY CIRCULATOR DIAGRAMS.

off eighty to eighty-six per cent. at point of terminal compression, and leaves sufficient to steady the reciprocating parts when the engine is drifting at high speed.

The circulation of the air in cylinder from one end to the other through the medium of the circulator valves and pipe, keeps the temperature of the cylinders normal. The air is neither chilled by the use of the relief valve opening to the atmosphere nor is the degree of heat run up by compression at high speed, noticeable. As is quite well known, the force that is responsible for this heat is the weight of the train pushing the engine down hill with throttle closed in opposition to the retarding power developed in the cylinders by compression and partial vacuum. When the piston valve engine is at the mercy of these two contending forces, the degree of heat is so high that cylinder oil is not effective.

This arrangement on either a single expansion piston valve engine or on the large cylinder of a compound engine, relieves the engine of the necessity of drawing on exhaust nozzle for relief to neutralize the effect of vacuum resistance present in the cylinder of the engine when drifting. This vacuum resistance not only induces heated gasses and cinders from the firebox and front end to enter the cylinders through the nozzle, thereby destroying all lubrication on surfaces and fouling all movable parts of the piston packing in the cylinders as well as the valves, but it is also responsible for an excessive use of fuel. This fuel must be applied to protect the tubes, etc., from injurious drafts when the engine is drifting as the draft on the fire is very severe because of the induction through the nozzle to which the fire is exposed, To protect the firebox the coal must be applied even though the safety valve is blowing.

Relief valves appearing in connection with the circulator are intended for the purpose of relieving the large cylinders of compound engines of the excessive pressure when reducing valve or other appliances fail. Also to relieve the cylinders on piston valve engines of water which finds its way to these cylinders when the engine primes. This question of water in cylinders of piston valve engines has given serious trouble where water is inclined to foam or prime. It has been responsible for broken cylinder heads, forcing piston rod fits off or on crossheads (this depending on which end the water got trapped in), doubling up main rods and other annoyances of a similar nature.

Baldwin Simple 2-8-0 for the Long Island Railroad.

The Long Island Railroad has recently purchased some 2-8-0 engines from the Baldwin Locomotive Works. The cab is of the kind generally called "Mother Hubbard," and it is placed very close to the smokebox. The sandbox, auxiliary dome and dome proper and bell are all behind the cab, the center of which is just above the rocker arm.

The engine is simple, with cylinders 21x28 in. The driving wheels measure 51 in. outside tires. The weight of the whole machine is 165,080 lbs., and it is capable of exerting a tractive effort of 41,160 lbs. The ratio of tractive force to adhesive weight is as 1 is to 3.47, the weight on the drivers being 143,080 lbs. The driving wheel base of this engine is 14 ft. 6 in. and only the front and rear drivers are flanged. The total wheel base of the engine is 22 ft. 9 in. The pistons drive on the third pair of wheels and the eccentrics are placed on the axle of the pair ahead. In order to make the eccentric rods of sufficient length, the links are carried beyond the rocker and a short transmission bar runs from link block back to rocker. The valve gear is the usual indirect type and the valves are the ordinary balanced slide.

The boiler is of the straight top variety with wide firebox. The outside diameter of the first course is 72 in. The back sheet is $84\frac{3}{16}$ in. high, and the hood for the protection of the fireman is bolted flat down upon the roof sheet. The height of the crown sheet is such as to leave plenty of steam room above it. There are 330 tubes 11 ft. 7¼ in. long, giving 1,993.2 sq. ft. of heating surface, the firebox gives 192 sq. ft., making a total of 2,185.2 sq. ft. The grate area amounts to 70.6 sq. ft.

The tender has steel frame and trucks having boxes working in jaws with equalizers. The tank holds 5,000 gallons of water. The weight of the engine and tender in working order is about 265,000 lbs. Some few of the principal dimensions are as follows:

Cylinder—21 x 28 in.

Boiler—Dia., 72 in.; thickness of sheets, [illegible] in.; working pressure, [illegible] lbs.; fuel, anthracite or bituminous; staying, radial.

Firebox—Length, 119⅛ in.; width, 85½ in.; depth, front, 62 in.; back, 60½ in.; thickness of sheets, sides, [illegible] in.; back, [illegible] in.; crown, [illegible] in.; tube, [illegible] in.; water space, front, [illegible] in.; sides, [illegible] in.; back, 3⅛ in.

Tubes—Material, iron; gauge, No. [illegible]

Heating surface—Firebox, 192. sq. ft.; tubes, 1,993 2 sq. ft.; total, 2,185.2 sq. ft.

Driving wheels—Dia., outside, 51 in.; journals, [illegible] in.; engine truck wheels, dia., 30 in.; journals $5\frac{1}{2}$ x [illegible] in.

Wheel base—Total engine and tend., [illegible] ft. [illegible] in.

Weight—On driving wheels, 143,080 lbs.; on truck front, 22,000 lbs.; total engine, 165,080 lbs.

BALDWIN CONSOLIDATION FOR THE LONG ISLAND RAILROAD.

Where Railroad Travelers Were Not Hurried.

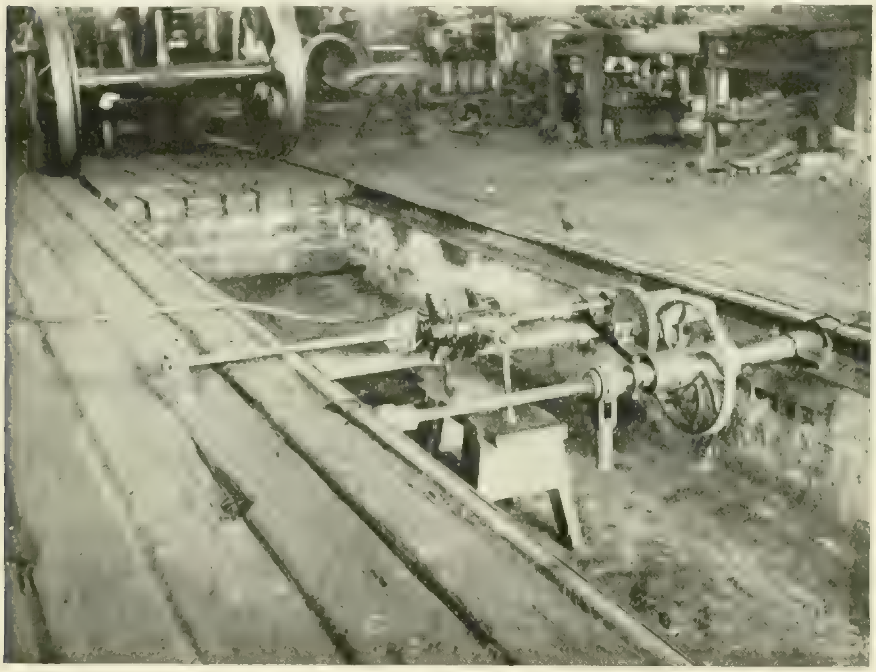
In 1845 the series of small railroads connecting Albany with Buffalo were connected so that an unbroken journey could be made so far as the cars were concerned. But the people managing the lines acted as if travelers had no right to be in a hurry. Trains were not permitted to run after dark in New York state. Trains going West stopped at Syracuse all night. Through trains from Buffalo east stopped so that the passengers had supper and breakfast in Auburn.

In Pennsylvania and Maryland the railroads did not pay much attention to the shades of night falling. As early as 1838 sleeping cars were run between Baltimore and Philadelphia and various Pennsylvania lines soon fell into the habit of providing seats which could be converted at night into fairly comfortable beds.

Another Air Valve Setting Machine.

This very efficient machine shown herewith for revolving the main wheels of a locomotive during the operation of valve setting, has been operated for several months at the Chicago, Milwaukee and St. Paul shops, at Minneapolis, Minn. The idea has been worked out by Mr. James M. Brearley, general foreman, applying an ordinary air motor to the gear of a cylinder boring bar attached to single rollers in each pit rail, the motor being operated by a tradle on the outside of pit. Right and left tram centers are taken on one wheel. One machinist and an apprentice boy are all the labor required for valve setting. Speed as well accuracy in stopping at tram centers are also among the fine features of the machine. Mr. Brearley has several other devices of value. One being a flue rolling attachment to an air motor which we shall be pleased to give the readers of your valuable journal in the near future.

EVAN M. JONES,
Minneapolis, Minn. Foreman.



HANDY AIR VALVE SETTING MACHINE.

A Sound Sleeper.

Flagmen have repeatedly met death by sitting on the track and falling asleep remaining in that condition until struck by the train they went out to stop. There is the familiar illustration of the miller going to sleep beside his wheel and it is believed that some people sleep peacefully in streets traversed by elevated railroad trains while others lie undisturbed when the Pullman car porter crashes up a neighboring bed into position. These people may be considered sound sleepers, but they hardly equal a man whose performance got into the papers lately. He was on his way to be married and had to wait at a noisy junction for a belated train. He fell asleep in the waiting room that all the trains for the day passed and did not awake until he was roused, when it was time to close the waiting room. He was kept entirely awake for some time after reaching his destination, after all the wedding guests had gone.

Steel Cars.

In the topical discussion of steel cars Mr. A. L. Humphrey, of the Chicago & Alton, who spoke first, pointed out that no one has questioned the advisability of the steel car from a purely traffic standpoint. It reduces dead weight and so permits increased percentage of revenue load. Repairs to steel cars are phenomenally low, and when railroads acquire shop equipment capable of handling repairs caused by wrecks or otherwise, the work will be as simple as it now is to wooden cars.

The composite car, that is one with steel underframe and wooden superstructure when used in hauling coal, as far as service is concerned, is equal to the all-steel car, but the ratio of dead weight to paying load is higher for the composite car than it is with the all-steel car. In case of wrecks the composite cars do not stand as well as the all-steel cars, but in the matter of ordinary maintenance there is very little difference in the cost.

The question, however, arises: "What will be the comparison in ten to twelve years hence?" The one danger which besets the future of the steel car is deterioration due to corrosion and rust. The composite car has been thought by some to be superior in this respect to the all-steel car, but the experience of the Alton appeared to be that the composite car with its wooden floor and sides became soaked with water and moisture from the coal, and this keeps the metal parts of the car damp with water containing sulphur and other injurious elements, all of which help on the corroding action, especially where this contaminated water drips upon the steel. On one car which was specifically mentioned it was found necessary to scrape and paint three or four times a year.

From experience obtained with the high side steel hopper gondola the speaker saw no reason why an all-steel frame box car should not be as successful as the all-steel gondola is. The same advantage with reference to dead weight and paying load, would apply to them as it now does to the gondola. With proper steel underframing and truck and with suitable design of draw gear, running repairs to freight equipment can be brought down to a minimum. The matter of design, however, is important, as successful design must do away with the possibility of corrosion by preventing water dripping on the metal. Remove the possibility of corrosion and the steel car, will be everlasting. The steel car has come to stay and some preventative must and will be found. The outside of the car can be taken care of now, but the preservation of the inside of the car has not yet been successfully accomplished, and there is important work in this direction yet to be done.

Consolidation Company Raise Rates.

The New York, New Haven & Hartford Railroad Company have shocked many freight shippers by making a considerable advance in freight rates. The advance will range from one to two cents per hundred pounds, and there will also be a readjustment of coal rates, which were advanced recently 10 and 20 cents per ton. The New York, New Haven & Hartford Railroad Company are in an unusually good position for raising transportation rates, for the reason that they have practically no competition, and it is well known that they own the legislatures of several states. It appears that the company, in advancing their schedule of rates, endeavored to spread the increase so that it would touch the whole community, which proves that the management are entirely satisfied that they can defy public sentiment without fear of retaliation. There have been talks several times since the decision in regard to the Great Northern Railroad merger case of something being done to test the legality of the New York, New Haven & Hartford Railroad Company absorbing and operating competing lines; and it may be that the new burdens which they have imposed upon the people may

induce some public spirited citizen to bring their case of merger before the courts. It is a good opportunity for some village Hampden to make himself famous by defying aggressive might as represented by the president of the consolidated lines.

American Locomotive Report.

Directors of the American Locomotive Company met on June 24, and the following statement was given out by President Callaway:

Earnings of the company for the year ending June 30, 1903, with the month of June partly estimated, were $32,863,730, an increase over the previous fiscal year of $6,465,337. More than $4,000,000 has been expended in enlarging the different plants, and in introducing modern machinery. The work of improving and enlarging the plants now outlined and authorized by the directors will be completed during the next fiscal year. The expenditures already made have produced an increase in the output of 40 per cent. The company has orders for a large number of engines to be delivered in 1904. Full detailed reports of the year's operations will be furnished to stockholders as soon as the books are closed, and the inventories can be made. The regular dividend on the preferred stock is payable July 21 to stockholders of record on July 2.

The Lubrication of Railroad Rolling Stock.

We recently received a letter from a locomotive superintendent in Great Britain asking for particulars of the system in vogue by which American railways obtain lubricants and other oils for the use of their machinery. After making careful inquiries we find that the Galena-Signal Oil Company are supplying lubricating and other oils to about 97 per cent. of the present railroad mileage of the North American Continent, which with double track, side tracks, etc., amounts to about 204,000 miles, operating about 39,000 locomotives, 40,000 passenger cars and 1,640,000 freight cars.

This business was commenced thirty-four years ago and has gradually grown up to its present dimensions. The usual plan followed by the Galena-Signal Oil Company is to make a contract with the railroad company whereby they guarantee that the cost per thousand miles on the different classes of equipment, namely, locomotives, passenger cars and freight cars, shall not exceed a certain maximum figure, which is determined on the previous performance on the railroad entering into a contract with them. When a contract is renewed after it has once been made, the guarantee for renewal is determined on changes that have been effected and results that have been secured during the term of the preceding contract.

The Galena-Signal Oil Company maintain in the United States and elsewhere in the world, where they have established business, a corps of mechanical inspectors, who are experts in the matter of lubrication, devoting their entire time and attention to studying the question of applying the oils so as to give the greatest satisfaction. If railway officials desire them, these experts are assigned to their roads free of charge, to assist the railroads to secure the greatest mileage with the least consumption of oil. These experts, when assigned to roads, have no authority to issue instructions covering the use of the oil, but only inspect existing conditions and practices and make recommendations to the proper railway official controlling lubrication. If their recommendations are found to be good, and the railway official approves of the same, he takes such action as he deems fit. If he does not see fit to adopt the suggestions made by the company's expert, it is not incumbent upon him to do so. It is found, however, that almost invariably the railway officials accept and put into force the suggestions or recommendations made by the experts.

When trouble arises anywhere with hot boxes or defective lubrication of locomotives special experts are assigned to investigate and they never fail to overcome the difficulty.

In addition to their lubricating oils, they manufacture a Signal Oil, to be used in hand lanterns, tail lights and wherever necessary on a railroad to have a perfect burning oil with an adhesive and constant flame.

The lubricating oils manufactured by the Galena-Signal Oil Company are:

Perfection Valve Oil. Galena Car Oil. Galena Coach Oil. Galena Engine Oil, and Galena Coach-Engine Oil.

The valve oil is composed of the very best products it is possible to obtain, compounded with the utmost care, the testing and laboratory departments taking precautions to see that all of the materials are exactly right before the oil is made; and after it is compounded it is again tested to make certain that the mixture has been properly effected and that the product is uniform with their standard.

The Galena brands for the lubrication of journals of cars, coaches and engines, and the moving parts of engines, are compounded of whale oil, red lead and the best crude petroleum obtainable, namely, Franklin Crude Oil. They are located right in the center of the only district in the world producing this quality of oil, and taking an oil that is the best natural lubricant known, they add to, or strengthen it by the addition of whale oil, which is recognized the world over as one of the best lubricants obtainable, and red lead. Through their process the red lead becomes a part of the compound and is held in the oil in solution. It assists lubrication by being conveyed to the journal, or part to be lubricated, and fills the interstices which are to be found in the most highly polished piece of steel, making the same smoother, and decreasing friction.

In addition to the domestic business the Galena-Signal Oil Company com-

BOMBAY, WITH OFFICES OF BOMBAY, BARODA & CENTRAL INDIA RAILWAY IN FRONT.

menced several years ago soliciting foreign trade, and now have substantial business in Peru, Chili, the Argentine Republic, Uruguay and Brazil. They have started in England, where the business has grown steadily, though slowly. They have two very large contracts in France, and substantial business in Spain, Italy and Egypt. Their oils are being used from a southern temperate zone through the tropical, northern temperate, and even in the northern frigid zones of the world, and are found to give complete satisfaction everywhere, under all climatic and geographical conditions.

The Steam Turbine.

The following is an abstract of a paper read by Mr. L. R. Pomeroy at the Railway Master Mechanics' Convention.


VICTORIA STATION, GREAT INDIAN PENINSULAR RAILWAY, BOMBAY.

More interest has probably been manifested by steam users in turbine development than in any single subject of a mechanical nature which has come up in steam circles during the last twenty years, or since the application of steam power to electrical generation has been an accomplished fact. And by many experienced steam engineers it is believed that the turbine will accomplish a revolution in the methods of generating electric power for all purposes.

A gasoline fluid, such as steam, in passing from a receiver at one pressure into a receiver at another pressure, acquires a definite velocity, due to the difference in pressure. For example: Steam at 150 pounds pressure expanding into the atmosphere is capable of imparting to itself a velocity of about 2,950 feet per second, and if expanded into a vacuum of 28 inches, will attain a velocity of about 4,000 feet per second. A jet striking a surface will exert a definite pressure against that surface, the value of which, in the case of normal impact, is expressed by half the square of the velocity per second into the mass of the fluid delivered against the surface per second. Should a surface against which such a jet impinges, such as that of a vane attached radically to a shaft, remain fixed, there will, of course, be no energy delivered to the shaft; it is also evident that should the vane have the same velocity as the impinging jet, no energy will be delivered, since there is no exchange of velocity between the jet and the vane. The maximum amount of energy delivered will be when the vane has about one-half the velocity of the jet, for in that case the remaining velocity in the jet after impact will equal the velocity of the vane, and therefore be incapable of imparting further energy. Speaking broadly, in order that a single wheel steam turbine may act at maximum efficiency, its vanes should have a velocity of about 2,000 feet per second working between the foregoing limits of pressure, that is, not far from the velocity of a projectile from a modern piece of ordnance. The spouting velocity of water discharged from a nozzle with a 100-foot head is 80 feet per second. These figures illustrate the radical difference or conditions between water turbines and steam turbines. On account of the lower velocity of the water jet, it is possible to approach the speed of revolution in the water turbine corresponding with the theoretical maximum economy. The elasticity of steam, however, as contrasted with the non-elastic condition of water, compels the compounding of the steam turbine, as the compounding of the water turbine would destroy its efficiency, while the momentum of the steam, though checked by the first series of buckets, recovers itself instantly by expansion, and is checked again and again by successive series of buckets, until the steam has expended its expansive force. It is thus readily seen that the problem encountered in the steam turbine is to extract from the steam the work due to its velocity without exceeding a moderate rate of revolution of the shaft carrying the vanes upon which the steam expands its velocity.

In the Curtis turbine the reduction of speed is obtained: First, by placing the vanes upon which the steam impinges at a relatively great radial distance from the axis of revolution, since for a given speed of peripheral velocity, the revolutions will be inversely as the radius. Second, by a gradual absorption of the velocity of the steam at the periphery of a number of vane wheels; and instead of having all of these wheels in one chamber, they are divided into two or more groups of three or more wheels, contained in separate chambers, but secured to the same shaft. This provides for the development and partial absorption of velocity in stages, the work being equally divided among the several stages.

The De Laval turbine depends almost entirely on an initial velocity due to complete expansion of the steam in the nozzle while with the Parsons, being of the parallel flow type, the energy imparted to the vanes is that due to the expanding steam through the wheel. In the Curtis, advantage is taken of any initial velocity due to the amount of expansion in the nozzle, availed of, coupled with the additional velocity as the result of expansion through the turbine. Velocity is imparted to the steam in the expanding nozzle so designed as to efficiently convert nearly all the expansive force, between the pressure limits used, into velocity of the steam itself. After leaving the nozzle, the steam passes successively through two or more lines of vanes on the moving element, which are placed alternately with reversed vanes on the stationary element. In passing successively through these moving and stationary elements, the velocity acquired in the nozzle is fractionally abstracted, and largely given up to the moving element. Thus the steam is first thrown against the first set of vanes of the moving element, and then rebounds alternately from moving to stationary vanes until it is brought nearly to rest. By this means a high steam velocity is made to efficiently impart motion to a comparatively slowly moving element. The nozzle is generally made up of many sections adjacent to each other, so that the

steam passes to the wheels in a broad belt when all nozzle sections are in flow.

In steam consumption, several of the present commercial forms of steam turbines show economic performances somewhat less than those of the most efficient reciprocating steam engine, such as is designed for pumping service, though apparently fully equal to the best types of reciprocating engine used in electrical generation and superior to the ordinary engines employed in that service. A specific advantage claimed, however, is that there is very much less falling off in economy at fractional loads as compared with the best type of reciprocating engine, which, it is perhaps unnecessary to add, is a point of the highest importance in electrical generation. Moreover, there are the undisputed commercial advantages of considerable less cost of turbo-generator unit and less floor space occupied. Moreover, the possibility of using a very high degree of superheat with the turbine still further extends its possible economic advantages over the reciprocating steam engine. A 600 kw.* unit showed an economy of 19 pounds of dry steam per kw. hour full load, and 20 1-2 pounds at half load; this is the equivalent of 12 1-2 pounds per 1 horse power hour full load and 13 1-2 pounds at half load; and with 150 degrees superheat, 16.75 pounds per kw. full load and 17.8 pounds a half load, or the equivalent of 11 pounds per 1 horse power at full load and 11.7 pounds at half load.

A very interesting fact concerning the development of the steam turbine is that large and small turbined are nearly equally efficient.

The steam turbine lends itself directly to solutions of problems involving the necessity of concentrating the largest amount of power in the smallest possible area consistent with economic operation.

Some of the advantages are:

1. High steam economy—full load economy being substantially the same as the overload economy, thus permitting of a very large overload capacity, and the fractional load economy being but little inferior to that of the full load.

2. Extreme mechanical simplicity—there being no packing except a single shaft packing on the top of the turbine which is required to hold only one or two pounds pressure, the bearings have no weight and the wear on the parts will be substantially nothing.

3. Extremely small floor space—in the larger sizes about .02 sq. ft. per kw. of rated capacity.

4. Perfect symmetry of form.

5. Uniformity of expansion with no alignment difficulties.

6. Ideal form and speed of generator.

7. Accessibility of all parts.

To sum up: if then, we can offer a prime mover for the generation of electricity, that is more simple than the complex piston engine, the cost of mainten ance of which will be less on account of this simplicity; that is more economical of operation and of space occupied, and withal, that is cheaper, it would seem that the subject of steam turbines ought to interest nearly every steam user.

* Kilowatt written kw. is in the electrical measure of power and is equal to 44,250 foot pounds per minute, a little over one third more than a horse power. One watt is 44.25 foot pounds per minute and represents the energy of one ampere urged by one volt.—Ed.

No More Car Sparking.

The New York & Stamford Railroad Company, which operates a trolley line in Larchmont, Rye and other towns on Long Island Sound, has a superintendent of a very courageous nature. He has discovered that its motormen and conductors devote too much time to their young women friends, and has posted an order, which reads:

"The last three seats and rear platform are reserved for smokers. To be more specific, do not reserve it for your 'lady friend.' Let her be seated with the rest of the crowd. It may have a tendency to decrease the number of complaints received at the office lately. The conductor's place is on the rear platform, unless he is collecting fares, issuing transfers or assisting passengers on or off the car."

The company, it is said, employs the best-looking motormen and conductors in the State, and many young women have been in the habit of riding on the platforms and in the rear seats to talk with them.

Intent to Deceive.

The grand jury of the United States court, sitting in Scranton, Pa., last month, found a true bill against Alt. F. Clark, Conrad Lotz, Louis Conrad and W. M. Bingham, proprietors of the Correspondence Institute of America, for using the United States mails to defraud.

One of the witnesses before the grand jury in the case was George Lines, of Connecticut, who stated to your correspondent that when he took a scholarship in the Correspondence Institute he thought he was enrolling in the Scranton school, of international reputation.

The Baldwin Locomotive works of Philadelphia are one of the largest employers of workmen of all trades in this country, or any other, except Krupp's, possibly. No less than 15,000 men are now under the roofs of the Baldwin works, and the pay roll amounts to $190,000 weekly. The capacity of the works is equal to five locomotives daily, but in April last 197 complete engines were turned out, with an average weight of 125 tons, and valued at $2,750,000.

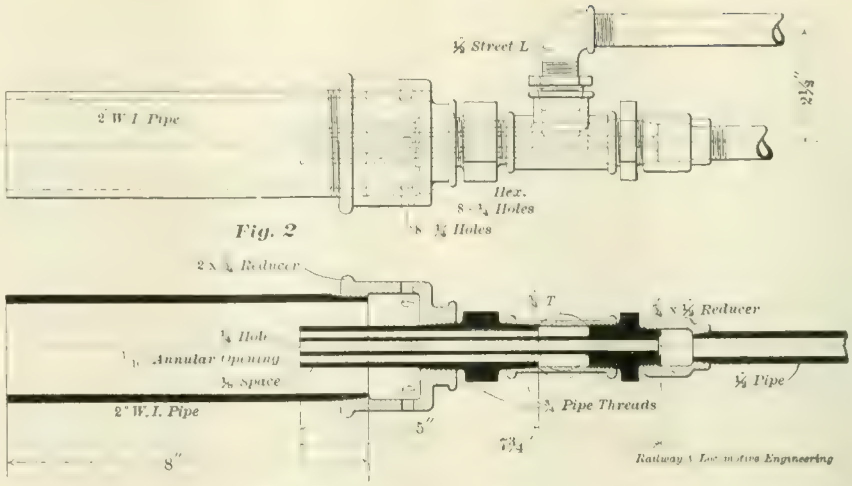
ADMINISTRATIVE OFFICES OF BOMBAY, BARODA & CENTRAL RAILWAY, INDIA.

That correspondence instruction is filling a real need is no longer questioned by thoughtful people. It not only brings an education within the reach of thousands of people who otherwise could never have one, but it increases the influence of the resident technical schools and colleges by stimulating a wide-spread interest in education, and by acting as a "feeder" in preparing young men for the higher institutions of learning.

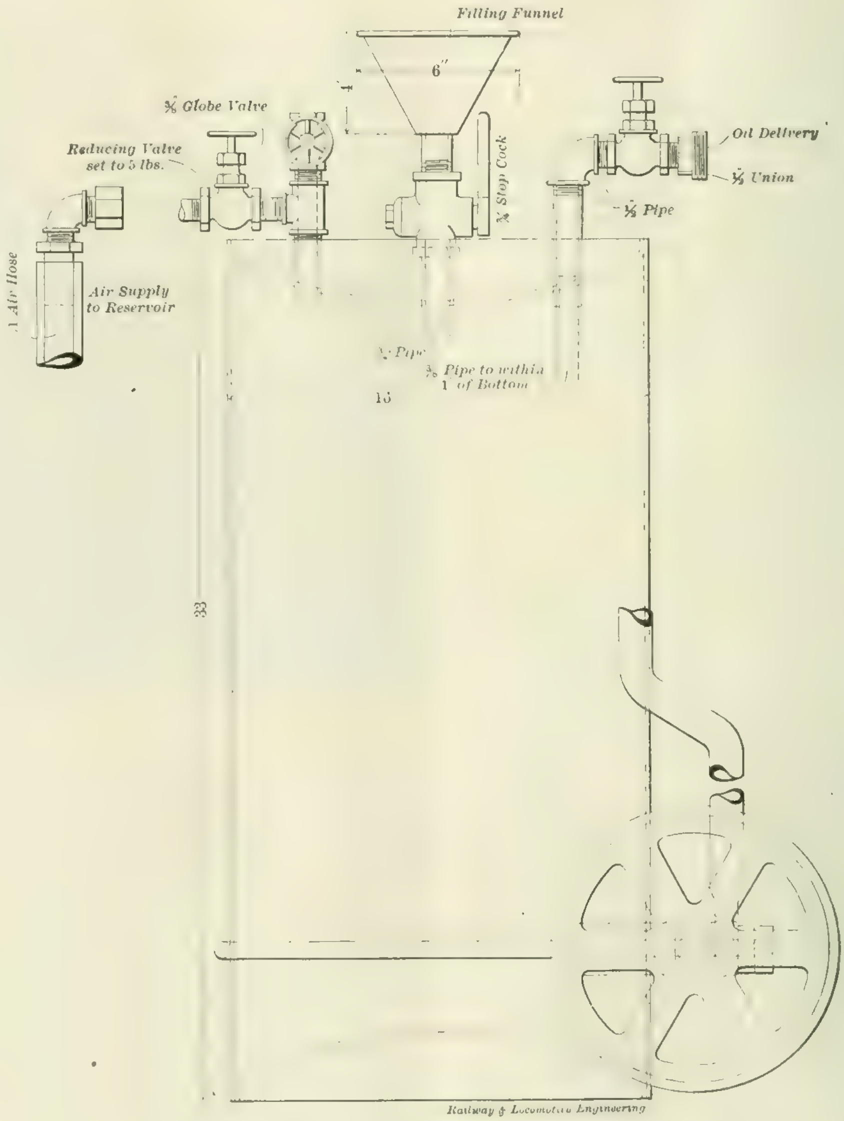
Pratte's Crude Oil Burner.

The accompanying sketch shows an appliance used on the Colorado & Southern Railway for heating tires, bent frames or any other part of an engine, without removal. The device is the invention of Mr. C. A. Pratte, foreman at the C. & S. shops at Denver. It consists of an oil reservoir mounted on a pair of wheels, a burner and combustion chamber. When not in use the whole apparatus can be wheeled about the shop like a wheelbarrow, two pipe handles, not shown, projecting out beyond the filling funnel, for that purpose. When at work the reservoir stands in the upright position resting on its base.

Fig. 1 gives a side view of the reservoir, with attachments and valves on top of the reservoir; Fig. 2 shows the burner. The combustion chamber, not shown in the illustrations, is mounted on a stand, which can be raised or lowered at will by the operator. A Westinghouse reducing valve is used to regulate the pressure and is set to 5 pounds, that being amply sufficient and giving the best results. The device has already proved its worth, and it is not patented. We are indebted to Mr. Rathbone, of the C. & S., for the blue print from which our illustrations were made.



PRATT'S CRUDE OIL BURNER.



TANK FOR PRATT'S CRUDE OIL BURNER.

The Morris Canal and Banking Company, which owns the Morris Canal in New Jersey, have filed an application with the State authorities for permission to abandon the operation of the canal, because it has not paid operating expenses since 1876. Yet the politicians of New York State are working up public sentiment to permit $101,000,000 to be spent on enlarging the Erie Canal. The Erie Canal has been a quarry of graft for politicians ever since it was built. The proper thing to do with that ditch is to close it up for it never will compete with railroad transportation that can move freight for ¾ cent per ton mile. This is apparent to everybody but Governor Odell and other hungry politicians, and so the agitation is kept up to increase the Erie Canal boodle reservoir. It is nothing else any more. There is no use arguing against the canal enlargement for no one favors it except those who think they can obtain for themselves or their friends part of the immense tax they are trying to cozen out of the rate payers.

The Hamilton Machine Tool Company, of Hamilton, Ohio, have recently issued a very fully illustrated catalogue, No. 4. The half-tones and the printing are excellent, and there is an index at the back of the book by means of which the particular description of the various tools made by this concern can readily be found. The Hamilton lathe comes in for special mention, being built in various sizes and adapted to different kinds of work. Other tools and appliances are mentioned in the catalogue and each has a line cut or half-tone illustration with descriptive letter-press accompanying it. The company will be happy to send this catalogue to anyone who is interested enough to write to them for a copy.

Of Personal Interest.

Mr. W. W. Boulineau has been appointed traveling engineer on the Central of Georgia Railway, with headquarters at Columbus, Ga.

Mr. H. Bentley has been appointed road foreman of engines on the Chicago, Rock Island & Pacific with office at Valley Junction, Iowa.

Mr. Thomas H. Pindell has been appointed superintendent of the Wyoming division of the Lehigh Valley, vice Mr. John T. Keith, transferred.

Mr. W. K. Thompson has been appointed superintendent of the Twenty-fourth District, Canadian Pacific Railway, vice Mr. D. R. Bell, transferred.

Mr. A. Tripp has been appointed superintendent of terminals for the Southern Railway Company at Jacksonville, Fla., vice M. E. H. Barnes, resigned.

Mr. Norton A. Mears has been appointed storekeeper on the Indiana, Illinois & Iowa Railroad, at Kankakee, Ill., vice Mr. C. C. Dibble, promoted.

Mr. J. J. Scully has been appointed acting superintendent of the Twenty-third District, Canadian Pacific Railway, vice F. Dillinger, on leave of absence.

Mr. T. McHattie, master mechanic of the eastern division of the Grand Trunk Railway system, Montreal, has been enjoying a vacation in Scotland this summer.

Mr. John M. Lynch has been appointed traveling engineer on the Chicago & Great Western Railway. He will have charge of the Northwest division of the road.

Mr. George T. Depue has been appointed master mechanic on the Erie Railroad at Hornellsville, vice Mr. Joseph Hainen, resigned, to accept service with another company.

Mr. S. R. Richards, master mechanic on the Southern Railway at Selma, Ala., has been transferred to Spencer, N. C., in a similar position, vice Mr. J. T. Robinson, resigned.

Mr. John T. Keith has been appointed superintendent of the Buffalo division, and the Lake lines of the Lehigh Valley Transportation Company, vice Mr. L. H. Van Allen, resigned.

Mr. D. A. Robinson has been appointed road foreman of engines on the Chicago, Rock Island & Pacific on that portion of the line between Rucklin, Kan., and Santa Rosa, N. M.

Mr. H. K. Mudd has resigned his position as master mechanic of the Chicago, Cincinnati & Louisville. This road was until recently called the Cincinnati Richmond & Muncie Railroad.

Mr. T. W. Turner, road foreman of engines on the Canadian Pacific, has lately had the territory he supervises extended to include the whole of the Lake Superior division of that road.

Mr. John W. Dalman has been appointed assistant master car builder of the Union Tank Line Company, with office at No. 26 Broadway, New York, vice Mr. Willard Kells, resigned.

Mr. A. H. Fetters has been appointed assistant mechanical engineer of the Union Pacific, with office at Omaha, Neb. Mr. Fetters has been chief draughtsman on the road for a number of years.

Mr. E. L. Gibbs has been appointed road foreman of equipment on the Red River and Fort Worth and the Rio Grande divisions of the Frisco system, with headquarters at Sherman, Tex.

Mr. D. G. Farragut has been appointed representative of the Pressed Steel Car Company in Mexico. His office is at Calle de Gante 8, Mexico City, where all the business of that republic will be handled.

Mr. T. J. Lockwood has been appointed trainmaster, Charleston Division of the Southern Railway, vice Mr. M. Kelly, resigned. The office of assistant superintendent at Blacksburg, S. C., has been abolished.

Mr. S. L. Bean has been appointed master mechanic on the Santa Fé system at Albuquerque, vice Mr. H. P. Barnes, resigned. Mr. Bean has been in charge of the shops of the Northern Pacific at Brainard, Minn.

Mr. George Smith, formerly master mechanic at Albuquerque on the Santa Fé system has been appointed master mechanic on the Illinois Central, in charge of the Burnside shops, vice Mr. F. E. Place, resigned.

Mr. C. L. Acker, heretofore erecting foreman and inspector on the El Paso-Northeastern System, at San Bernardino, Cal., has been appointed general foreman of all shops on the system, with headquarters at Alamogordo, N. M.

Mr. Edward Haskins, who has for the past twelve years been foreman of the Burlington blacksmith shops at St. Joseph, Mo., has resigned his position to accept service with the new locomotive building concern in Montreal, Canada.

Mr. George R. Henderson, superintendent of motive power on the Atchison, Topeka & Santa Fé, has handed the company his resignation, which goes into effect on August 1. Mr. Alfred Lovell, assistant S. M. P., has been appointed acting superintendent of motive power.

Mr. T. A. Summerskill, superintendent of motive power on the Central Vermont, who was injured not long ago in an attempt to capture a burglar, has now recovered and is able to resume his railroad duties. His many friends are pleased to know he is at work again.

Mr. Thomas McPherson, for the past two years foreman of the motive power department of the Chicago & Northwestern at Des Moines, has been promoted to the position of general foreman of motive power and machinery, with the same company, at Eagle Grove, Iowa.

Mr. Lacey R. Johnson, assistant superintendent of rolling stock of the Canadian Pacific Railway, accompanied by Mrs. Johnson, sailed a few days ago on S.S. *Bremen* for their native land. Mr. Johnson is enjoying a well-earned vacation. He will be some time in England, and intends to visit the continent.

Mr. E. H. Symington, formerly connected with the T. H. Symington Co., of Baltimore, is now associated with the Railway Appliances Company, of Chicago and New York, as manager of the Symington journal box and dust guard, the Railway Appliances Company being agents for the Chicago territory.

Mr. R. M. Hoffman has been appointed assistant superintendent in the operating department of the Manistee & Grand Rapids Railroad Company. Mr. Hoffman will, in the absence of the superintendent, perform such duties as might be incumbent upon the superintendent were he on duty. The office of roadmaster has been abolished.

Mr. W. D. Hatch, formerly with the Railway Department of the International Correspondence School, has been appointed air brake instructor on the Canadian Pacific Railway. Mr. Hatch began railroad work as a fireman on the Canadian Division of the Michigan Central and was promoted to the position of engineer on the same road. His experience includes service on the West Shore and on the Pere Marquette.

Mr. W. H. Lewis, of the Lehigh Valley Railroad, was elected president of the American Railway Master Mechanics' Association for next year. Messrs. P. H. Peck, of the Chicago & Western Indiana; H. F. Ball, of the Lake Shore

and J. F. Deems, of the Vanderbilt lines, were elected vice-presidents. Mr. Angus Sinclair, editor RAILWAY AND LOCOMOTIVE ENGINEERING, was elected treasurer of the association, and Mr. John W. Taylor was again elected secretary.

Mr. George H. Gibson has resigned as manager of the advertising and publication department of the B. F. Sturtevant Co., of Boston, Mass., to accept an appointment with the International Steam Pump Co., having offices at 114-118 Liberty street, New York City. Mr. Gibson was formerly connected with the Westinghouse Companies' Publishing Department, of Pittsburg, Pa., and was for two years a member of the editorial staff of the *Engineering News*, of New York city.

Mr. F. W. Brazier, assistant superintendent of rolling stock on the New York Central, was elected president of the Master Car Builders' Association for the ensuing year. Mr. W. P. Appleyard, M. C. B., of the New York, New Haven & Hartford; Mr. Joseph E. Bucher, assistant superintendent of machinery, Illinois Central, and Mr. W. E. Fowler, M. C. B., Canadian Pacific, were elected vice-presidents. Messrs. D. T. Crawford, of Fort Wayne; J. T. Chamberlain, of Boston; J. S. Chambers, of Florence, S. C., and T. S. Lloyd, of Scranton, form the executive committee of the association Mr. John Kirby, of Montreal, was elected treasurer, and Mr. John W. Taylor, of Chicago, was elected secretary.

Mr. Calvin W. Rice, of the Nernst Lamp Company, of Pittsburg, Pa., has announced his resignation from the company, to the universal regret of his business associates, who found in him that combination of executive ability and personal attraction so much to be desired Since May, 1902, Mr. Rice has held the position of second vice-president, to which he later added the duties of sales manager. To his efforts is due in a large measure the success of the company and its present substantial commercial standing, the past year having been a particularly successful one. Mr. T. H. Bailey Whipple, who has been associated with the Sawyer-Man Electric Co. as assistant to the second vice-president, succeeds Mr. Rice in the Nernst Lamp Co. Mr. Whipple, who was formerly connected with the Janous Electric Company, of Cleveland, O., is a man of wide experience and acquaintance in the electric lighting field, and eminently fitted for the position which he assumes.

One of the most persistently abused and persistently persecuted public officials in New York is President Vreeland, of the Interurban Street Railway Company, and president of the New York Railroad Club.. Mr. Vreeland went through an excellent practical railroad training that seems to have made him ready for every emergency and he always comes up smiling in front of his accusers and tormentors. When they expect to obtain a victory, they generally sneak away after a humiliating defeat. One of the most persistent rumors about Mr. Vreeland is that he has decided to resign his position with the Interurban Company and go away to the country for his health, or accept a position under Yerkes to straighten out the urban transportation problems in London. We have no doubt but that he would help London very materially in straightening out their congested street railroad traffic. He has lately been invited to appear before the Royal Commission which is investigating the question of surface traffic in London. He has gone over there to help out our English friends and to take a holiday. Mr. Vreeland is a great joker and we expect to hear some amusing stories of his experience among the great men of London. We have not yet heard that he was dining with King Edward, but we would not be surprised to learn that he had a special invitation to go to Windsor.

Grand Chief P. M. Arthur.

While beginning to speak at a banquet which closed a union meeting of the Brotherhood of Locomotive Engineers

PETER M. ARTHUR.

held at Winnipeg, Manitoba, P. M. Arthur, grand chief of the Brotherhood of Locomotive Engineers, dropped dead. Mr. Arthur, although sixty-nine years old, was a remarkably well preserved man, and was seemingly in excellent health when he was stricken down.

Peter McArthur was born in Scotland in 1834, and came to this country with his parents when he was six years old. He began railroad work as a blacksmith's helper and shortly afterward obtained a position as fireman on the Schenectady & Utica division of the New York Central Railroad. Here he rose to be a passenger engineer. He took a very active part in the Brotherhood of Locomotive Engineers and was elected chief of his division. Having written something for publication about Brotherhood matters the printer left out the c of Mc and his name went abroad as P. M. Arthur. That name suited him and he determined to abide by it. He was elected grand chief in 1873 and proved to be an exceedingly efficient leader. He had the rare peculiarity of always remembering names and faces. In conventions he would sit in the chair and name every member who rose to speak. This in itself was a great source of popularity. The rules of the Brotherhood required that he should be re-elected every three years, and he always was elected by a big majority, although at different times there was bitter opposition.

P. M. Arthur was Grand Chief Engineer not only in the technical sense, not only as the master of the Grand Lodge. He was the Grand Chief Engineer in even a wider and more exalted sense, because like all other successful engineers he guided, not wrecked that which was entrusted to his care. He strove, not wantonly to exhibit to mankind the extent of the power of which he was the master, by disastrous collision, in the economic world, with those who temporarily opposed him, but like the true chief engineer he guided and controlled the mighty forces within his grasp, so that the total effort of his powerful organization was steadily forward along the line of progress and good will, and behind it safely followed the material advancement for the hosts of the brotherhood who so loyally put their trust in his coolness, his judgment and his inviolable honesty of purpose.

P. M. Arthur was the most successful leader of a united labor the world has ever seen. A variety of attributes contributed to his success. The first was his natural ability as an organizer. Without that his earnestness, honesty and fairness would have availed little. One of his favorite expressions was "Let us reason together." When he found any section of the Brotherhood in a fierce mood over grievances that he believed were not serious, he would collect the leaders together and say "Let us reason together." No attempt was ever made to abuse earnest men, they were quietly invited to subject all differences to the test of reason. The same policy was followed with railroad officials. When they were inclined to be unjust the Chief of the Brotherhood invited them to meet their aggrieved employees, to reason together. Most of them came to agree that conciliation was better than conflict.

The success of the policy always advocated by Mr. Arthur made him very much of an autocrat of late years, but it was the supreme power yielded willingly to many years of successful management.

His voice and influence were always used against one man power, and he dominated the making of a constitution which prevents one man from ordering a strike, or from committing the organization to any violent conflict.

P. M. Arthur did his work well. Few rulers of men have left behind them a monument of greatness such as was achieved by this God fearing locomotive engineer.

Pulaski Leeds.

The tragic death of Pulaski Leeds, superintendent of machinery of the Louisville & Nashville, robs that road of a highly capable and trusted motive power officer, and removes a familiar figure from the railroad world. Mr. Leeds was a native of Darien, Conn., and has been in railroad service since 1861. He was at one time a locomotive engineer on the N. Y., N. H. & H., and held the position of superintendent of motive power on the Boston & New York Air Line, and also on the Indianapolis, Decatur & Springfield, before going to the L. & N.

The facts concerning his death are, briefly, an employee, named Warner, in the electrical branch of the machinery department had not given satisfaction with some work at Decatur, and he was recalled, the intention being to give him employment elsewhere. This, Warner resented, and demanded a general letter of recommendation, the giving of which would have been contrary to the company's rules. Mr. Leeds offered to assist the man in other ways and signified his willingness to write an individual letter to anyone who should inquire about him. Warner insisted upon the general letter, and in a moment of unreasoning passion shot down the man who had thus offered to befriend him.

The sad death of Mr. Leeds is only one more terrible proof of the insensate folly committed by men who habitually carry firearms. If Warner had not had a loaded revolver in his hip pocket when talking to the superintendent of machinery his unreasonable ill-temper would probably have spent itself in a few hot words, and what was at best only a trivial episode in their lives, would never have deepened into tragedy and crime. No truer words were ever penned than those which Shakespeare puts into the mouth of King John: "How oft the sight of means to do ill deeds, makes ill deeds done."

Thomas Banister, of Winona, Ia., one of the oldest and best known engineers on the Northwestern system, died recently at his home in Winona, Ia.

Thomas Chalmers, father of Mr. W. J. Chalmers, chairman of the executive committee of Allis-Chalmers Company, died July 13 and was buried Thursday, July 16. Thomas Chalmers was the founder of the firm of Fraser & Chalmers, which firm was recognized as the world's largest producers of mining machinery. He was a native of Scotland, having been born at Dronley, near Dundee, and was just entering his eighty-eighth year.

T. A. MacKinnon, first vice-president and general manager of the Boston & Maine, died at his residence in Boston a few days ago. A funeral train carried the remains to Montreal for burial.

Mr. A. L. Humphrey, superintendent of motive power of the Chicago & Alton, has resigned to accept a position with Westinghouse Air-Brake Company, of Pittsburgh, Pa. He will be succeeded as S. M. P. on the Alton by Mr. W. J. Hemphill, formerly superintendent of motive power on the Jacksonville Southeastern Line.

MR. W. W. SNOW,

The Most Popular Manufacturer of Railroad Appliances. Had Lived Three-quarters of a Century on July 17

Educational Opportunities.

One scholarship in the Stevens Institute of Technology, belonging to the American Railway Master Mechanics' Association, is open, and candidates, who must be sons of members or of deceased members, are advised to apply to the secretary of the above association at once for a certificate authorizing them to attend the competitive examination.

Joseph T. Ryerson & Son, of Chicago, have donated to the Master Mechanics' Association, one scholarship in the Purdue University, on which they agree to pay $600 a year, to pay expenses of tuition and living, to the successful candidate. He is required to be:

First, a high school graduate.

Second, an employee of a shop coming under the jurisdiction of one of the members of the association.

Some of Sir William Van Horne's Railroad Experience.

Sir William Van Horne, chairman of the Canadian Pacific Railroad, was interviewed in New York not long ago by a young gentleman who insisted on treating him like a foreigner. The Montreal capitalist took it as a matter of course until the interviewer asked, innocently:

"Did you ever have anything to do with our American railroads, Sir William?"

The good knight's eyes sparkled as he answered: "Oh, yes. I served on both Alton and Illinois Central."

"In what offices?" asked the scribe, with pencil ready.

"I sold books on Alton and oranges on Illinois Central," said the chairman of the Canadian Pacific quietly; "but that was some little time ago."—*N. Y. Times.*

A Nickel Steel Engine.

One of two locomotives which are being built at Baldwin's Locomotive Works for the Canadian Copper Company will be a mechanical novelty in its way, as parts of it will be composed of nickel steel, making it cost about $4,000 more than the ordinary locomotive.

An important feature of the boiler from a mechanical standpoint will be that every one hundred pounds of steel in it will contain from three to four pounds of nickel. The parts which will be of nickel will be the frames and rods driving axles, crankpins, piston rods and other important parts of the machine.

The castings and forgings have been made by the Bethlehem Steel Company. The International Nickel Company, which controls the Canadian Copper Company, will provide the nickel.

The American Steam Gauge and Valve Manufacturing Company, of Boston, recently gave their annual dinner to their sales department. This is a feature which the company brings out every year. They have their traveling salesmen, branch house managers, together with the head office officials go over the business of the year thoroughly and wind up with a dinner. We have had the pleasure of seeing the menu, and when we find that the Benedictine punch used on that occasion was said to be the president's mixture and the champagne was designated as the treasurer's delight, there is little doubt of the generous hospitality of the hosts or of the genuine good will of the party. About fifteen or twenty sat down to dinner and thus pleasantly celebrated the close of a year of prosperity for the company.

For everything you have missed you have gained something else; and for everything you gain you lose something.
Emerson.

Over the Santa Fe Trail.

BY ANGUS SINCLAIR.

Second Paper.

When the train turned southward at La Junta, the passengers at once began to look for the mountains. It does not matter how short a time a person may have been away from the sight of the ocean or of mountains, he, and especially she, is certain to search with pleasing anticipation on approaching either to enjoy the first sight. It is an interesting study to watch the way different people enjoy their first sight of mountains or of any other striking phenomenon. Some are struck with silence and they may be credited as being full of speechless emotion, or plunged in the stupidity that is never touched with anything that cannot be eaten. Our car load of Endeavorers displayed hysterical enthusiasm, not to say gush, and their admiration was not of the silent kind.

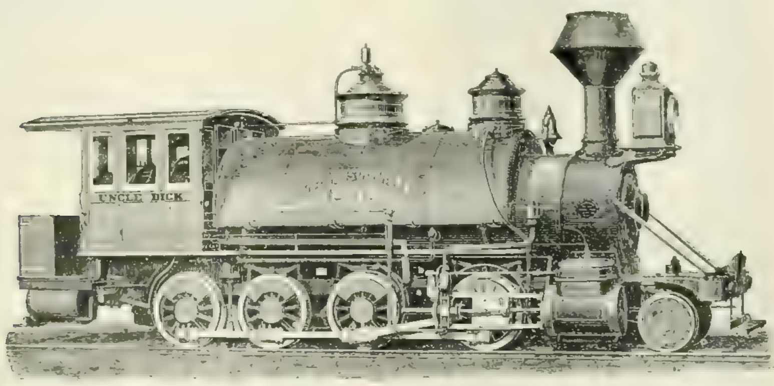
The enjoyment to be derived from sightseeing depends very much upon the spirit in which the sightseer starts out. I once knew an old Scotchman whose son had made a fortune in the United States and resolved to take his father out to see the wonders of America. The old man was one of a type of his countrymen who are always in opposition; who constitutionally disagree with other people. He was a devoted admirer of his own country, and was very dubious about seeing anything in foreign parts that would surpass the beauties and wonders of Scotland. The principal cities were visited, but the old man could not see that any of them was so attractive as Edinburgh and Aberdeen—maybe a wee bit bigger was the most he would admit. Various mountain scenes were passed through, but the father would not admit that they were grander than the Grampian hills and, "man," he would remark, "they lack the life and color that the bloomin' heather spreads over our hills." As a last resource the son took his father to Niagara Falls and watched to see the effect. The old man looked on a minute almost in wonder, and remarked, "it's a great spate (flood), but it would be more wonderfu' if it fell up instead o' doon."

The first seventy miles of the southbound Santa Fé trail excites more expectation than satisfaction. The hazy outlines that can scarcely be distinguished from low-lying clouds, are said to be domes belonging to the great Rocky Mountains; but the admiration must for a time be based on faith. We are in Colorado and nearly in romantic New Mexico, and I hear objections raised to the name of the stations we pass. Thatcher, Tyrone, Earl, repeats our young ladies in disgust; but El Moro sounds better and then we reach Trinidad, a modern town with furnaces and smoke and street cars, and a curious mixture of brick, frame and adobe houses; but a few miles out brings touches of the Spanish-speaking people with adobe huts, women and children in high colored rags, and men lounging under sombreros. The frame section house has given place to low, oblong adobe houses, and we see swarthy-faced trackmen who handle a tamping tool as if it were a spear.

But now we are among the real mountains, whose profusion of towering peaks can be seen without artificial aid. The transparent air vanquishes distance and the naked eye can distinguish Pike's Peak, a hundred miles away. Far and near are scenes of grandeur, mountain piled upon mountain with chasms and canyons and valleys opening between and the whole softened by green trees and shrubs and other verdure that ranges from deep blue to yellow. The unanimous decision of the Endeavorers is, "Isn't it lovely?"

The railroad is ascending the mountain to get over through the Raton Pass, and the locomotives are toiling slowly, for they rise 185 feet for every mile advanced. There is no going around, so the grade must be climbed up through the Devil's Canyon, winding and twisting under many a giddy precipice and overlooking awful gulleys, but always ascending until we plunge into a black tunnel which takes us out into sunny New Mexico.

The operating of trains over this Raton Pass has been a difficult task for the Santa Fé management and they have always used the best power available for doing the work. One of the first movements connected with the building of enormously powerful locomotives was inaugurated in connection with the steep grade over the Raton Pass.



"UNCLE DICK," ONCE THE MOST POWERFUL ENGINE IN THE WORLD.

When the line was under construction in 1879, and while the piercing of the tunnel was going on, the road was operated by a switchback with a grade of 316.8 feet to the mile, and having curves of 359 feet radius. The temporary track was at first operated by ordinary American type engines with cylinders 17x24 inches; but they hauled such light loads that a special engine was ordered from the Baldwin Locomotive Works. The engraving annexed shows the "Uncle Dick," a consolidation engine with saddle tank, which had 1,700 gallons capacity. The cylinders were 20x26 inches, the driving wheels were 48 inches diameter and the engine weighed in working order 115.000 pounds. It was then the heaviest and most powerful locomotive in the world, and continued to be so for several years.

The Uncle Dick does not, however, compare very favorably with the powerful engines working the same grade today. Its tractive power is about 26,000 pounds; the tractive power of some 2-8-2 Vauclain compound engines built at the Baldwin Locomotive Works this year for the company is about 62,000 pounds.

Uncle Dick is called after Dick Wooten, a pioneer, who was a very important personage in these parts at one time. He became possessed of the land through which the Santa Fé train passed over the north side of the pass, and erected a toll house and collected toll from all wagons that used the trail. The moldering ruins of the toll house are still to be seen near the railroad track.

When the railroad company began constructing the line over the pass, Uncle Dick, as he was familiarly called, objected to the intrusion upon his rights, privileges and solitude and gave the surveyors a great deal of trouble. He would neither sell nor donate the right of way, and was inclined to declare war upon the intruders. When the track was built close to his domain, certain officials went up there with a private car which was liberally provided with the good things of this life. Uncle Dick was invited to enjoy the hospitality of the visitors and before they left he had agreed to grant the right of way in consideration of an annual pass over that part of the line.

Anyone with the slightest knowledge of road construction is certain to be impressed with the skill displayed in the locating of this line which involved unusual engineering difficulties. The hunters who acted as guides to the first traders were the real locating engineers, for they knew every ford over rivers and every defile through the mountains. For many miles the train was seldom out of sight of the Santa Fé Trail. The locating engineers faithfully followed its route, only cutting off detours where the natural obstructions could be cut through or bridged.

When the trail turned away from our route near Las Vagas, leading the way to the old city of Santa Fé, other trails took its place. The railway track is taken as a safe guide by pathseekers, and everywhere west of the Missouri river, a trail is to be see following within sight of every railway. The drivers of prairie schooners and other lonely vehicles, are willing to follow the railroad, knowing that though long stretches of wilderness may intervene, they will emerge eventually into places where men and women have established homes.

BUDS AND BLOSSOMS IN SOUTHERN CALIFORNIA.

As the train rushes along over its smooth track, diving through ravines and winding around mountain sides, through cedar forests and over grass covered plains, there is variety of scenes to suit every taste and novelties sufficient to excite frequent cries of admiration. The desert? "When are we coming to the Great American Desert?" were inquiries I frequently heard repeated. "This is the desert, sure," some one would say when an arid, forbidding stretch of country was struck, then we would suddenly emerge upon a valley green with alfalfa and blooming with fruit trees and the sight of the desert would be postponed; for the herds of sheep and cattle and evidences of life and activity had no suggestion about them of the desert.

IN A CALIFORNIA VALLEY.

There is, notwithstanding, real desert enough and to spare on the route; but most of the infertile plains and valleys blossom like the rose when touched with life-giving moisture. The floods that now devastate the land in the rainy and thawing seasons will some day be hoarded up and circulated as it is wanted to make the thirsty earth produce food for the nations. The work is well begun in some places, and proofs are abundantly given that the earth will produce fullness if man only will do his part.

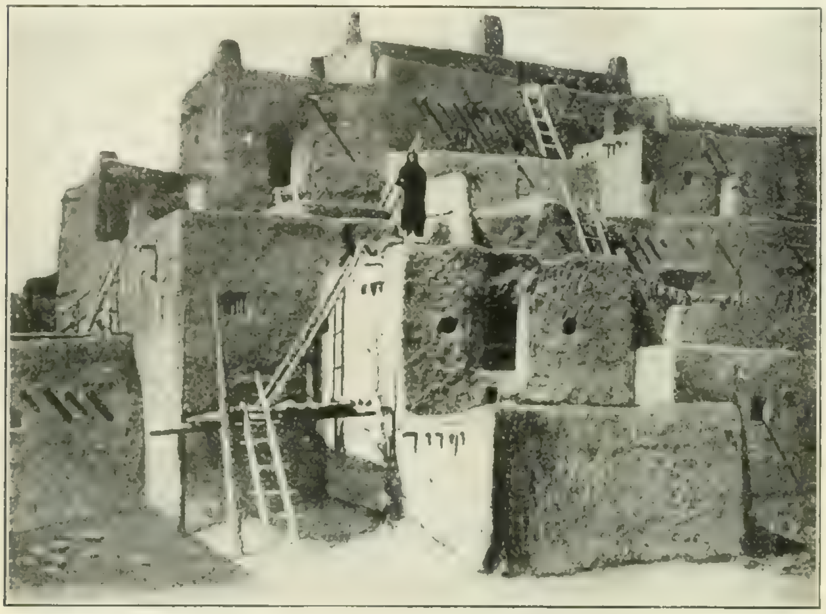
The cities of Las Vegas (the meadows) and Albuquerque are the only places of importance touched in New Mexico by the railroad. They are well worthy of closer inspection than a through traveler can give. There are numerous pueblos, small Indian villages with swarthy denizens to be seen, who seem to suffer from the chronic scarcity of water, for most of them look as if they did not wash themselves once a year. "Lo, the poor Indian!" is picturesque in the distance, but, like the bagpipes to untrained ears, distance lends enchantment to the intercourse.

ROAD WINDING OVER THE MOUNTAINS.

Notwithstanding its arid plains and bare, rugged mountains, there are many things of interest to be found in New Mexico and Arizona. During more leisurely visits, I have enjoyed much pleasure looking up places of physical and historical interest. Santa Fé is one of the oldest cities ruled under the United States flag, and possesses antiquities and venerable looks that no other city in the Union can boast of. Its history is a stirring romance, but want of space prevents me from touching on that part of its attractions. Even more interesting to me are certain community dwellings built by the aboriginal inhabitants of the country, each one being a town in itself, the substantial stone houses having been built generally in inaccessible locations for defense against enemies. They represent the remains of a departed civilization which may have been contemporaneous with the glories of ancient Egypt.

When we are in search of ancient remains we find things in this arid region that no other country possesses. There are petrified forests which are unique. Huge trees converted in Nature's laboratory into agate and jasper, are objects of antiquarian interest that tortures the imagination to conceive the age of their growth and period of their conversion.

As we approach California a real desert is at last encountered, a dreary stretch of sand, gravel and alkali with labyrinths of black rocks and almost entire absence of things that grow, even the yucca and cactus being stunted.



A NEW MEXICAN PUEBLO.

Out of this world of desolation we descend by a steeply descending grade into Southern California. The long-looked for orange groves spread out in regulated rows and all sorts of semi-tropical plants testify that we have reached the land of perennial sunshine.

AMONG THE BIG TREES OF SOUTHERN CALIFORNIA.

Flues Are Set Too Close.

It frequently happens in reports and papers presented to technical associations, that the most important point in the discussion of a subject is covered up in an obscure paragraph and overlooked. We think that this was the case in the excellent report on Recent Improvements in Boiler Design Presented to the last Master Mechanics' Convention. Designers of locomotive boilers are rather indiscriminating in their demand for more heating surface. Our sympathies are with a paragraph in the report which reads:

"There is a question among some officials that, while we have ample heating surface, it may not be in the right place, or, in other words, it is possible that we have too much heating surface in the wrong place, that is, are not too many tubes used, and would not a boiler furnish an equivalent or a higher evaporation with a lesser number? There appears to be good reasons for questioning the efficiency of a multitude of tubes, among which are the following for reducing the number: A better circulation due to the wider spacing of centers; a reduction of liability to leakage, and longer life to tube sheet due to the greater section of material between holes. It is not apparent that there are any very serious difficulties to surmount in making tests that will demonstrate to what extent evaporation and cost of maintenance is affected by a wider spacing of tubes. Such experiments would definitely decide whether the practice of encroaching on circulation space with tubes is conductive to an economical evaporation, and in addition would no doubt incidentaly furnish some needed light on the effect of a higher ratio of fire box to tube heating surface under the new conditions. Restricted water spaces around the fire box are well known to be inimical to a proper circulation, as well as dangerous to the sheets, and the same effects are known to operate at the fire box ends of tubes. The wide fire box has shown a marked tendency to crack at the sides, and as a remedy it is proposed to make the fire box ring 4½ inches wide on some engines now under construction."

In the discussion that followed the presentation of the paper Mr. O. H. Reynolds of the American Locomotive Company, a member of the committee, emphasized the points made in the foregoing paragraph. He said:

"The matter of flue space and its effect on circulation was referred to in the report of the committee, and I deem it only proper that it should be brought before the association for the purpose of emphasizing the fact that it is something we must give some attention to. Ever since the locomotive has been a factor in transportation, this question of circulation has been of vital importance. Fifty years ago the eminent engineer, the late D. K. Clark, formulated some values for tube spacing, which appear to apply as well to present-day conditions as to those of his time. He selected engines known to give a high evaporation on a low fuel consumption, and from that data determined that the distance between tubes on one-eighth of an inch should not be less than one-thirtieth of the total number of tubes. That was for engines of about the year 1860, or in that neighborhood, where the tube numbers were lower than in the present case. For that time the number would be about 150 flues, and would give a space of about five-eighths for that number of tubes.

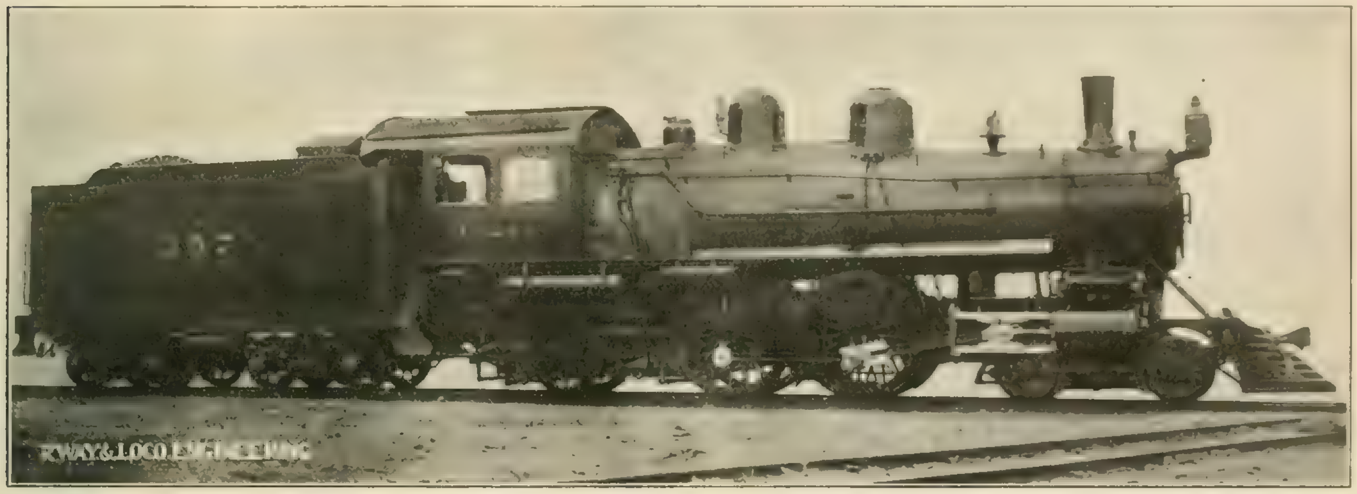
We have engines running to-day with over 300 tubes where the space is not more than five-eighths of an inch, and there is no question in the mind of the thinker that this fact has a good deal to do with the lack of circulation in our boilers. For clearance between tubes and boiler shell, some recommend one-six-

teenth of the diameter of the shell for the the upper rows of tubes. We make a distance of ½ inches on boilers 72 inches in diameter. We know we have boilers of that diameter where the flues approach a great deal closer to the sheet than that, and its effect on the circulation is evident. Herr Von Borries, in recent tests, placed the limit of rate of evaporation at 14.5 pounds of water per square foot of heating surface per hour. This figure comes very close to known records, and known results recently obtained. He also places the limit of rate of combustion at 97 pounds of coal per square foot of grate surface per hour. We can get no such evaporation at that low rate of combustion. It will amount to pretty nearly twice that.

I think it is proper and meet, that this association should take some steps to demonstrate what effect a reduction of the number of tubes in a boiler would have; that is to increase the center space —and that would mean a reduction in the number of tubes—to show what the result would be. These tests should be made both in the laboratory and on the road; the laboratory tests for refinements to show exactly what can be done, and the road tests to see if actual practice confirms the expectation adduced by the laboratory tests.

Baldwin Four-Cylinder Balanced Compound for the Santa Fe.

The Baldwin Locomotive Works are building some Atlantic type engines for the Santa Fé. The engine we illustrate here is a four-cylinder compound in which the four pistons drive on the forward wheels which are mounted on a cranked axle. The cylinders are 15 and 25x26 inches, the high pressure ones being on the outside and the valves are of the balanced piston type. The driving wheels are 73 ins. in diameter. The pressure carried is 220 lbs. and the total heating surface is 3,083 sq. ft. The boiler measures 66 ins. diameter at the smoke-box end. The weight carried on the drivers is 101,420 lbs., and the total weight of the machine is 193,760 lbs. The tank capacity is 8,400 gallons. The cranks and crank pins are so placed in this machine as to practically form a self-balanced engine. Her performance on the road will be watched with considerable interest.



BALDWIN FOUR CYLINDER BALANCED COMPOUND.

The Metric System in the Railroad Mechanical Conventions.

In acting upon a paper on the Metric System presented to the American Railway Master Mechanics' and the Master Car Builders' Associations, by Angus Sinclair, these organizations put themselves squarely on record as being opposed to a change in our system of measurements.

In the paper Mr. Sinclair briefly adverted to the efforts of the advocates of the metric system to push through Congress a bill to make the metric system the legal standard of weights and measures in the United States. The efforts of the metric system advocates are toward making the use of the French system compulsory, and even to proceed the length of changing the adopted screw thread standards, to make them conform to units of metric measurement. The author reminded the members of the great work their associations had done in leading to the general adoption of the United States screw threads, and dwelt on the conveniences resulting, not only to railroad companies, but to every manufacturing concern which uses bolts and nuts.

The metric system partisans say that the change in screw thread standards will be effected gradually, a pretense which reveals the impractical character of the men. They do not seem to realize the persistence of car and other railroad material. There are cars in use that were built fifty years ago, and the life of some of the million and a half of cars now in service is beyond computation. To-day a car built in California loses in Maine a nut off a bolt, and all the car repairer has to do is to look in his box for a nut belonging to that size of bolt and screw it on. These easy facilities of interchange car repairs are enjoyed over every railroad on this continent. This is a very beneficent change from the conditions existing anterior to the adoption of standard screw threads, when the car repairer would have had to search through a scrap pile for a nut to fit or probably put in a new bolt. The transition period in changing from one standard to another would throw railroad interchange of car repairs back into the old intolerable conditions.

Screw threads are mentioned merely as an example of one of the many inconveniences that would result from changing the unit of measurement. The inch and foot units are in themselves more convenient, especially for shop work, than any metric unit. The bisections of the inch and foot can be carried as far as refinement of measurement requires, and the subdivisions are easily remembered. With the four units of lineal measure, the inch, foot, yard and mile, there is always a convenient unit with a distinctive name, which the memory readily grasps and divides mentally when necessary. The attempts to push these units aside for a system whose additions and divisions are notoriously difficult to memorize ought to be opposed by all practical mechanics and business mer

These and other objections being presented the following preambles and resolutions were submitted:

"Whereas, A bill for the adoption of the metric system in the departments of the Federal Government has been reported favorably to the House of Representatives;

"Whereas, We consider that the only effect of such a law will be the creation of a government metric system and the

continuation of the existing system in ordinary commerce and industry;

"Whereas, It is evident that the confusion resulting from such a condition of things would be intolerable;

"Whereas, We believe a change in the system of weights and measures used by the people at large to be impossible, therefore be it

"Resolved, By the American Railway Master Mechanics' Association, and by the Master Car Builders' Association, in convention assembled, that we condemn all legislation intended to promote the adoption of the metric system in this country.

"Resolved, That we especially condemn the bill which was reported to the last House of Representatives as one which can do nothing but introduce confusion where we now have uniformity."

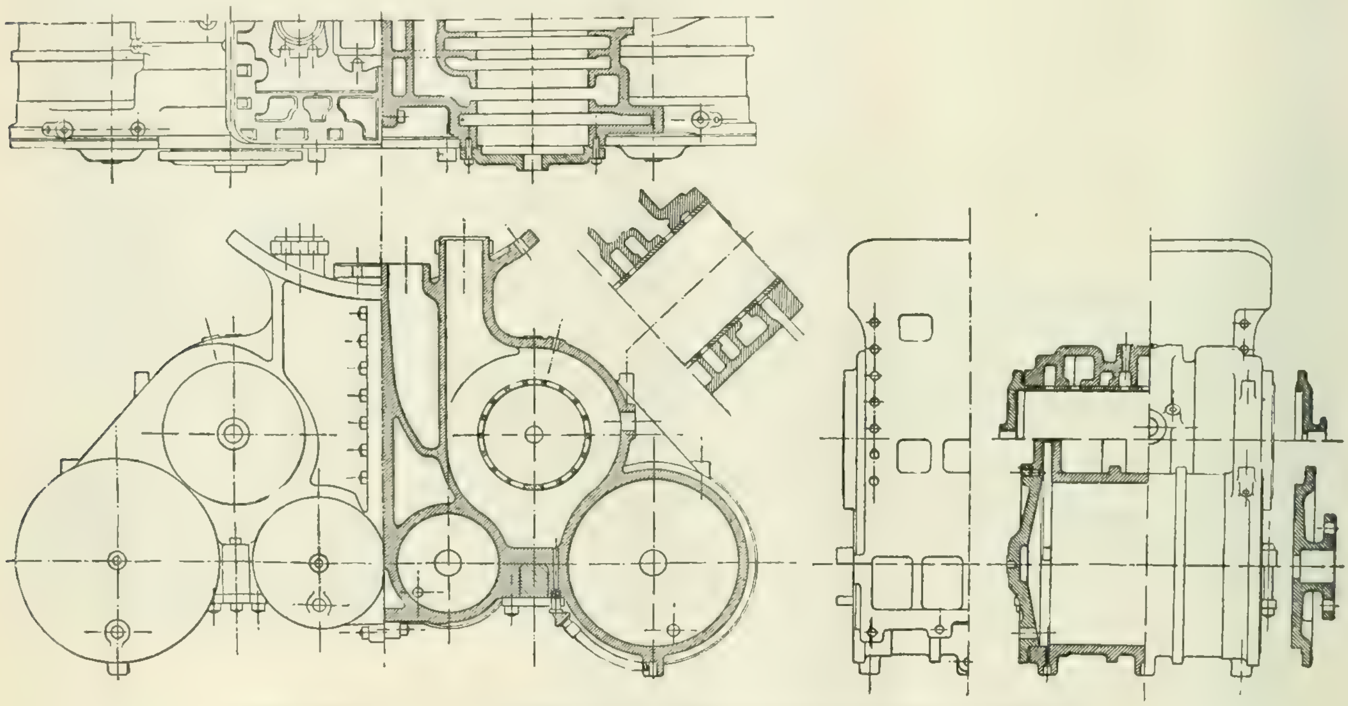
The resolutions were adopted after very feeble opposition, mostly of an academic character.

Berlin Brought to New York.

A few nights ago at one of F. F. Proctor's theatres, in New York, one of the most interesting moving pictures ever shown was exhibited. It was a continuous view taken from a car on the new "hanging railway" in Berlin. The scene was exactly what a passenger would look at as he apparently flies over the streets of that city, and the picture was recorded as seen by the "eye" of the kinetograph, or photograph-taking machine.

The Berlin hanging railway is in a sense an elevated road; two long continuous steel girders supported at intervals by steel pillars, are carried along the streets at considerable height above the carriage way. From these overhead girders the car hangs. Its trucks and motors run along the track over the roof of the car, so that to a spectator in the forward end of the car, the sensation is exactly as if he was flying over the city, just below an overhanging steel structure. Streets are crossed, stations are passed, a river is "flown" over, curves are rounded, sights are seen and cars moving in the opposite direction are passed as our car glides on. The motion is easy, steady, continuous and rapid. It is like the flight of a bird. In the kalatechnoscope pictures the illusion of flying is perhaps more complete than it would be in reality, because of the complete absence of noise. The picture is interesting as well as instructive, and would have been absolutely perfect if the car had been shown at rest before the trip began, with passengers entering and leaving, so that its construction and appearance might have been studied. As it was, however, it was a novel and most pleasing sight.

Science may have made the marvelous appear commonplace to some, though science to the thoughtful and observant. never really cheapens worthy achievement. By her aid we may sit in one of the Proctor theaters in New York on a summer evening, with the breeze of an electric fan cooling the air, and accompanied with the soft strains of music played by an orchestra hidden in the gloom which always falls just this side the stage—here we may experience the sensations and see the sights which a resident of far away Berlin feels and sees as he "flies" along on the overhead hanging railway in the capital of the German Empire.



ARRANGEMENT OF CYLINDERS AND VALVES, BALDWIN BALANCED COMPOUND.

A very decided drawback to the success of the Railroad Mechanical Conventions at Saratoga was the miserable acoustic properties of the room where the meetings were held. They were held in the ball room connected with the Grand Union Hotel, and we seldom sat in a hall where speakers labored under greater difficulties in trying to be heard. Complaints were made by leading members of both associations to the village authorities of Saratoga of the want of a suitable hall for holding conventions, and we understand that the people are now preparing a hall that will accommodate from 300 to 400 persons.

The Gold Car Heating and Lighting Company, of New York, report that the apparatus sold during the past year is nearly double that of any former year since the origin of the business. Orders have been received from the Canadian Pacific for 290 equipments, the Brooklyn Heights Railroad ordered 240, the Missouri Pacific 125, and the Wabash 105. Other railway orders come to 1,136 equipments or 1,896 equipments in all.

At the recent stockholders' meeting of the Rogers Locomotive works the following were elected directors: William Barbour, J. E. Brone, J. W. Griggs, John Havron, F. B. Lord, E. H. Norton, Stephen Peabody, J. D. Probst, Robert Pruym, James Henry Smith, Sir William C. Van Horn and Reuben Wells. It is a strong board, and indicates that these noted locomotive works are in good hands.

Let us be among the few who do their duty.—*Mr. Pecksniff.*

One of the strange losses incidental to the June flood at Kansas City was that of 38 box cars that burned to the water's edge, a rushing torrent isolating them from all other combustible matter. The cars in question were loaded with unslaked lime and when the water rose above the floor line the lime fired spontaneously and the upper part of cars were entirely destroyed. The blazing cars in the midst of a sea of water offered a strange spectacle and suggests the necessity of moving lime cars above the flood line—if you have time!

During the discussion on the metric system in the Master Mechanics' Convention Professor Hibbard told of his difficulty in understanding the British monitary system, with its pounds, shillings and pence, which is not divisible on a rational basis, and used that as an argument in favor of the meter as a unit instead of an inch. To us the force of the argument tended in the other direction. It offered a good reason why our mechanics should be permitted to continue using the plain inch, to which they are accustomed, instead of a strange unit of measurement with high falutin names which are more than foreign to their ears.

Petitions have been filed with the Interstate Commerce Commission by the Boston & Maine Railroad Company and the Denver & Rio Grande Railroad Company with the provisions of the safety appliance act. The former company asks for additional time to equip its passenger cars and locomotives with automatic couplers, and the latter for additional time to equip its locomotives with power driving-wheel brakes. The commission will give a hearing on the petitions in this city August 5.

The British Westinghouse Company has secured the contract for the electrification of the Wirral Railway, the same system to be installed as that now in successful operation on the Mersey Tunnel Railway. The Wirral Railway is about fifteen miles in length, and connects Liverpool by means of the Mersey Railway with the residential district of the Wirral Peninsula in Cheshire, England, West Kirby and New Brighton being the terminal points.

The Standard Coupler Company, of 160 Broadway, New York, are presenting their friends with a neat little paper-knife or letter opener. The knife in is the form of a dagger and is nickel plated both on handle and blade. The Standard Company are makers of the Sessions draw gear and the Standard steel platforms. Write to the company if you want to have a neat and useful desk accessory, or if you want to know anything about Standard railway material.

The Canadian Pacific Railway has placed an order with the Canadian Foundry Company of Toronto, Ont., for the construction of ten compound freight locomotives. The engines are booked for delivery in September. The cylinders are to be 22 and 35x26 in. Driving wheels, diameter 57 in. Weight on drivers, 144,-800 lbs. Total weight, 164,000 lbs. Pressure, 200 pounds; total heating surface, 1,876 sq. ft. Diameter of smallest boiler ring, 60¾ in. The tender will carry 10 tons of coal and the tank will contain 5,000 Imp. gallons of water.

The Hammond Packing Company have abandoned their plant at Hammond, Indiana, having spent over a million dollars in the construction of a fine new plant at the Union Stock Yards, Chicago. The new offices are lighted by three and six-glower Nernst lamps, sold through the Chicago Sales Office of the Nernst Lamp Company, and it is stated that a large additional number of these disseminators of light will soon be installed in their extensive packing house.

A large addition is being planned to the works of the Standard Steel Car Company, at Butler, Pa. The plans are now being considered by the officials of the company, and if approved the capacity of the works will be increased to 80 steel cars a day. The new addition will be about 400 feet long and about 100 more hands will be employed.

The Pennsylvania Railroad Company is equipping more of its offices with Nernst lamps, thereby attesting to the superiority of the illumination afforded by this now famous lamp. The Philadelphia office of the Nernst Lamp Company reports that twenty-six six-glower and five three-glower Nernst lamps have recently been installed in the freight department of the Pennsylvania Railroad at Broad and Washington avenue, Philadelphia, this being one of the most important departments of the company.

A news dispatch of July 19 from Meadville, Pa., says: A. B. Youngson, Assistant Grand Chief of the Brotherhood of Locomotive Engineers, is slowly improving from an illness which for several days was expected to result fatally. His physicians say that his chances for recovery are fair. He has been in the City Hospital for a month.

The Safety Car Heating & Lighting Co. has brought suit in the U. S. Circuit Court for the Northern District of New York, against the Consolidated Car Heating Co. for alleged infringement of its patents in connection with car heating devices.

The F. M. Hicks Locomotive and Car Works, Chicago Heights, report that among a number of orders recently received there are seventeen locomotives to be rebuilt, fourteen coaches, including baggage cars, to be overhauled, and two hundred and fifty-six freight cars of all kinds to undergo heavy repairs. This firm does all manner of repair and overhauling work to cars and engines.

Below is the kind of newspaper item we like to reproduce. Ignorance always aims at extremes. A speed of 100 miles an hour is a claim easily remembered: Articles of incorporation were filed yesterday in the office of the Clerk of Essex county, in Newark, N. J., by the New York-Buffalo Air Car Railway. The papers were prepared in the offices of James B. Dill, in New York. The charter gives the company power to construct an air line from New York to Buffalo. The cars run on steel rails, but the motive power is compressed air, and it is declared that the trains will attain a speed of 100 miles an hour.

A new car building company has been organized by leading business men of Cincinnati, which expects to do business on a large scale. Mr. Thomas B. Egan, of the well-known Fay & Egan Company, is the leading spirit of the enterprise. He is reported to be giving the car building scheme a great deal of personal attention.

Among the jetsam found in a Missouri Pacific round house at Kansas City after the late floods was a piano. It needed tuning and heavy repairs before it was in condition to charm the savage breast.

The New Castle Forge & Bolt Company, of New Castle, Pa., are installing in their plant the following electrical apparatus which has been purchased from the Westinghouse Electric & Manufacturing Company: Two engine-type generators, of 75 and 100 kilowatts capacity respectively, which will be operated by engines furnished by the Erie City Iron Works; seven 30 horse-power, direct-current motors, complete with rails and pulleys; and a three-panel switchboard with the usual auxiliary apparatus.

A conference was recently held between the management of the Boston & Maine Railroad, and the trainmen employed in freight service, with the result that a raise of 25 cents a day has been given to the latter. Switchmen employed in the freight yards will also get a similar increase.

Curiosity is and has been from the creation of the world, a master-passion.

—*Barnaby Rudge.*

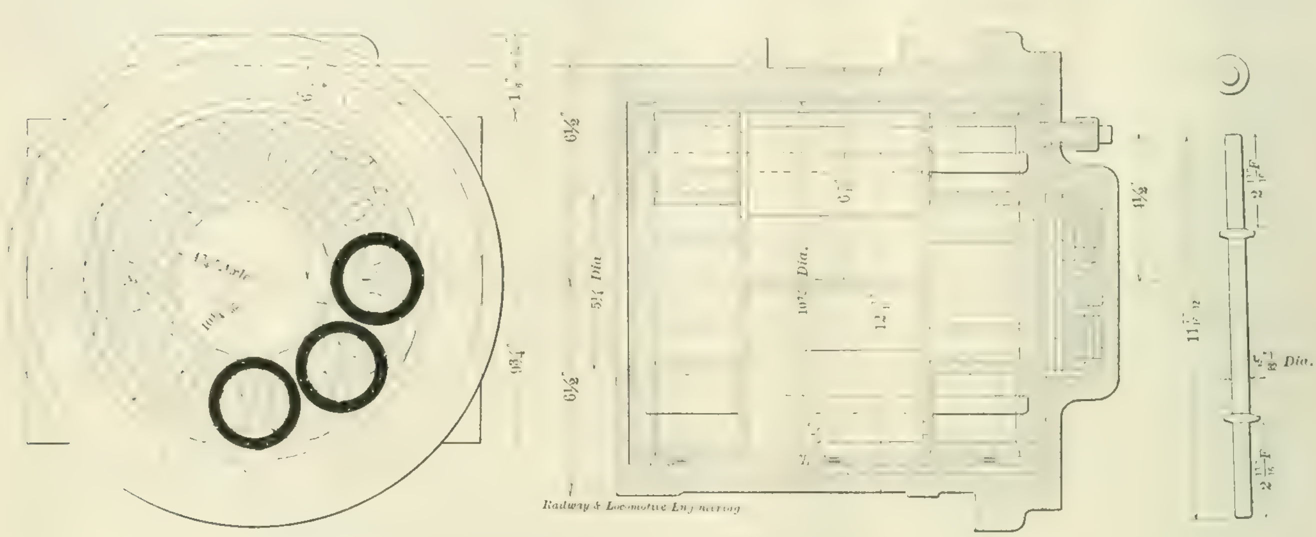
Roller Bearings in Passenger Service.

Through the courtesy of Mr. W. McWood, Superintendent Car Department for the Grand Trunk System, we are enabled to present to our readers some details of the roller bearings which are being used on several of their passenger cars, on suburban service.

The axle-box is circular inside, and is lined with a steel bushing which is dowelled into the bottom of the box to prevent the bushing turning round. Upon this bushing the rollers move. The rollers themselves are pieces of hollow steel tube 2¾ in. diameter outside, with walls ⅜ in. thick. The rollers are disposed around the journal in a curious way. There are three zones covered by the rollers. The central zone of the journal has round it eight rollers, each 5$\frac{5}{16}$ in. long. The two end zones have rollers 2⅝ in. long. There are also eight of these and the rollers in the two outside zones are placed with centers opposite each other, while those of the central zone are placed so that their center lines would pass between the outside circumferences of any two adjacent rollers in the outer zones. This position of the rollers is maintained by a very ingenious device. A set of steel rods about ½ in. in diameter, with collars placed so as to keep in touch with the ends of the rollers, are placed inside the rollers. Two rods are in each roller, and each rod passes through three rollers.

Our illustration shows the arrangement of axle, rollers and rods. The rollers in one zone are kept from interfering with those in another by the collars on the rods, and any two adjacent rollers are kept from rubbing against each other by the size and position of the rods. The external surface of the rods rolls on the internal surface of the rollers, and the rollers bear upon the axle and the internal bushing of the box. Lubrication is arranged for through oil grooves cut in the upper part of the steel bushing, just over the collars of the steel rods. Two or three men can push one of these cars along a level track.

The Grand Trunk officials use this roller bearing only on a certain number of suburban cars, which do not get far away from home at any time. The bearings were applied in 1895 and are still in service. The bearing makes the car run very easily and is a great advantage to suburban trains in that it enables them to be started much more quickly than an ordinary bearing would permit. An objection which has been raised to their use on heavy, through equipment, is that in the event of anything going wrong with a roller it might cause serious trouble, because all the rollers are continuously revolving round the journal, and within the steel bushing. The results so far which have been achieved with these bearings on the Grand Trunk, in suburban service, have been very satisfactory.



GRAND TRUNK ROLLER BEARING AXLE BOX

The Meaning of Being Well "Posted."

The word "posted," in the sense of being well informed is generally used in what is said to be, the coloquial way. That is, the word is correct enough in conversation, but is not generally so used when writing a book. The way in which the word has acquired the significance of *well informed,* is that one of its meanings is an appointment to some public or official place. A man may become, for example, an army officer. Such a man from the nature of the position he holds is required to instruct those under him, and when on duty at such work he was, so to speak, "on post," and the work he was doing gradually came to be described as "posting" his subordinates. The men so instructed, when they came to be proficient were said to be well "posted." The prerequisite to being well posted is to receive instruction and one of the best ways to get instruction is to read for yourself. Get hold of the literature of the subject you feel yourself to be deficient in. Look over our list of books and see if they do not strike you as an excellent means of "posting" yourself on all sorts of railway and engineering matters.

The first on the list is, of course, RAILWAY AND LOCOMOTIVE ENGINEERING, a practical journal of railway motive power and rolling stock. It costs only $2.00 a year, and is well worth the money, and besides the paper is a welcome visitor in every household. Let your wife and boys see it.

"Locomotive Engine Running and Management," by Angus Sinclair, is an old and universal favorite. A well-known general manager remarked in a meeting of railroad men lately, "I attribute much of my success in life to the inspiration of that book. It was my pocket companion for years." We sell it for $2.00.

"Practical Shop Talks." Colvin. This is a very helpful book combining instruction with amusement. It is a particularly useful book to the young mechanic. It has a stimulating effect in inducing him to study his business. 50 cents.

"Examination Questions for Promotion." Thompson. This book is used by many master mechanics and traveling engineers in the examination of firemen for promotion and of engineers likely to be hired. It contains in small compass a large amount of information about the locomotive. Convenient pocket size. We cordially recommend this book. The price is 75 cents.

"Compound Locomotives." Colvin. This book instructs a man so that he will understand the construction and operation of a compound locomotive as well as he now understands a simple engine. Tells all about running, about breakdowns and repairs. Convenient pocket size, bound in leather, $1.00.

"Catechism of the Steam Plant." Hem-

enway. Contains information that will enable a man to take out a license to run a stationary engine. Tells about boilers, heating surface, horse power, condensers, feed water heaters, air pumps, engines, strength of boilers, testing boiler performances, etc., etc. This is only a partial list of its contents. It is in the question and answer style. 128 pages. Pocket size. Price, 50 cents.

"Care and Management of Locomotive Boilers." Raps. This is a book that ought to be in the hands of every person who is in any way interested in keeping boilers in safe working order. Written by a foreman boilermaker. Also contains several chapters on oil-burning locomotives. Price, 50 cents.

"Locomotive Link Motion." Halsey. Any person who gives a little study to this book ceases to find link motion a puzzle. Explains about valves and valve motion in plain language, easily understood. Price, $1.00.

"Machine Shop Arithmetic." Colvin and Cheney. This is a book that no person engaged in mechanical occupations can afford to do without. Enables any workman to figure out all the shop and machine problems which are so puzzling for want of a little knowledge. We sell it for 50 cents.

"Firing Locomotives." Sinclair. Treats in an easy way the principles of combustion. While treating on the chemistry of heat and combustion is easily understood by every intelligent fireman. The price is 50 cents.

"Air-Brake Catechism." Conger. Nothing better can be found for persons trying to learn all about air brakes. Tells the whole story. We sell it. Cloth, 75 cents. Leather, $1.00.

"Skeevers' Object Lessons." Hill. A collection of the famous object lesson stories which appeared in this paper several years ago. They are interesting, laughable and best of all they are of practical value to-day. $1.00.

"Stories of the Railroad." Hill. Best railroad stories ever written. Those who have not read these stories have missed a great literary treat. $1.50.

"Block and Interlocking Signals." Elliott. Tells what signals are, what they do and how they do it. Comprehensive treatise on the subject. Ought to be studied by all trainmen where block signals are used. $3.00.

"Standard Train Rules." This is the code of Train Rules prepared by the American Railway Association, for the operating of all trains on single or double track. Used by nearly all railroads. Study of this book would prevent many collisions. Price, 50 cents.

"Mechanical Engineers' Pocket Book." Kent. This book contains 1,100 pages 6x3¼ inches of closely-printed minion type, containing mechanical engineering matter. It ought to be in the book case of every engineer who takes an interest in engineering questions. We use it constantly as a reference for questions sent to us to be answered. Full of tables and illustrations. Morocco leather. $5.00.

"Locomotives, Simple, Compound and Electric." Reagan. An excellent book for people interested in any kind of locomotive. It will be found particularly useful to men handling or repairing compound locomotives. It is the real locomotive up to date. $2.50.

RAILWAY AND LOCOMOTIVE ENGINEERING. Bound volumes. $3.00.

Hays Fired Them.

When "Hays of Wabash" became general manager of the Grand Trunk Railway he found himself confronted with a difficult problem in the shape of younger sons, nephews, cousins, etc., of certain English stockholders, who held nice fat positions on the system. Mr. Hays began to weed them out. There were much perturbation and much curiosity. A good many people expected to see Hays himself weeded out before long. Nothing happened. A friend of Mr. Hays met him one night and began to talk about the matter.

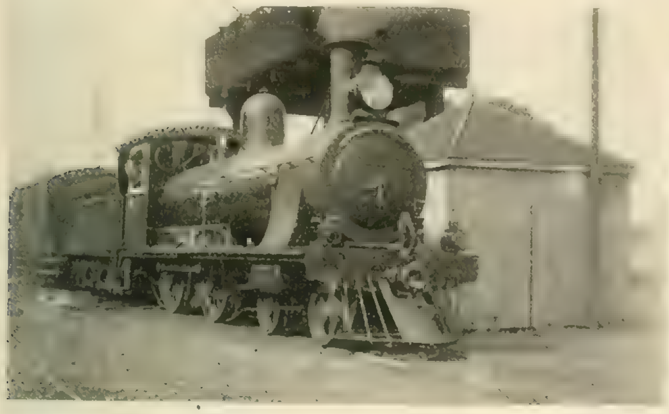
"How do you do it, Hays?" he asked. "Do you fire them first and then investigate their family, or do you investigate first?"

Hays smiled. "I just fire," he said. And perhaps that's the reason Grand Trunk is paying more dividends than ever in its history.—*N. Y. Times.*

Kincaid Stoker Illustrated.

The Kincaid Locomotive Stoker Company, of 1146 Harrison avenue, Cincinnati, Ohio, have issued an illustrated catalogue showing the stoker in various positions ready for business, with operating mechanism exposed, and with feed apparatus on view. The letter press explains the method of setting the stoker, its operation and the ease with which it may be disconnected in case anything *does* go wrong with it, but though that is only a remote contingency, it has been provided for in correct engineering style. The Kincaid stoker is a steam operated device, the hopper of which holds about three bushels of coal. Coal is thrown into the furnace in what may be called the foreground, the middle distance and the background of the firebox, so that an even distribution of coal is secured all over the grate. There is a small, vertically sliding door in connection with the stoker, through which the fireman may at any time examine the condition of the fire. The Kincaid Stoker Company will be happy to send a copy of the catalogue to any one interested enough to apply to them for it.

The associates of George M. Pullman were by no means the first to propose putting a covered vestibule between passenger cars. As early as 1852 a patent was granted to a man named Atwood, of Waterbury, Conn., for a closed vestibule between cars and it was applied to a train on the Naugatuk Railroad of Massachusetts, and was highly popular. It did not, however, increase the earnings of the company and for that reason it was abandoned.



LOCOMOTIVES BELONGING TO SOUTH AFRICAN RAILWAY

Convention Notes.

An improvement was made this year on the grounds of the hotel where the convention was held, by the opening up of some new "streets" of booths, and by carrying the whole area devoted to exhibits, farther back on the lawn. The weather was disappointing, but the same lively interest was manifested this year, as formerly, in the many and tastefully arranged exhibits which were to be seen upon veranda and lawn.

A feature which always adds to the enjoyment of those present is the services of that very efficient band which Mr. Church brought with him from Providence, R. I. This band earned the good will of all who heard them. Their repertory was extensive, and they played constantly while on duty. Mr. Church was most obliging in giving various selections which were asked for by his auditors. One could not fail to see the pleased expression which would light up the face of motive power and supply men alike, when the stacatto notes of the "Hiawatha" intermezzo were heard, or to notice how that pleased expression settled into one of calm enjoyment as the delicate and persuasively insistent tones of that popular air floated among the booths where wheels whirled, steam puffed and pneumatic apparatus snorted and sneezed in the interest of good railroading and pure science.

There was what might be called a full turnout of exhibitors and supplymen, and among the principal ones may be mentioned the following:

The Adams & Westlake Co., of Chicago, had, as is their custom, one of the most striking exhibits on the ground. They showed in their handsome pagoda the Adlake acetylene gas car lighting system. Not only were the elegant forms of chandeliers and lamp brackets dispalyed, but gas generators were shown and their mechanism laid open for inspection. At night the exhibit was practically self-explanatory, but in the day time the whole subject of car lighting was brilliantly illuminated by the enlightening remarks of Mr. F. E. Jones, the genial secretary of the company.

The American Balance Valve Co., Jersey Shore, Pa., was represented by Mr. K. T. Wilson. A model of the Wilson high pressure valve was shown, also the American Metallic Piston-rod and Valve-steam packing. The Nixon safety staybolt sleeve was also in evidence.

The American Brake Shoe and Foundry Co., of New York and Chicago, had a most interesting and excellent exhibition of their brake shoes, among which are the diamond "S," the Streeter, the Corning, the Sargent "U," the Lappin and the Cardwell patents. The steelback brake shoe was among the newest things shown, the shoe weighs 25 pounds when applied and is said to give a scrap of only 5 pounds, when worn out.

The American Steam Gauge & Valve Co., of Boston, Mass., exhibited a number of steam gauges with black and white faces and one-corrosive movement, also locomotive pop valves muffled and plain. The American Thompson Improved Indicator was on view among the other specialties and in connection with this indicator, the American ideal reducing wheel was shown. With this apparatus, all complicated and troublesome reducing gears are entirely done away with. Locomotive vacuum and relief valves formed part of the exhibit.

American Steel Foundries Co., of New York and St. Louis, had on exhibition the Davis Wheel center which was made from open hearth steel. The spokes of the wheel may be bent or twisted and so indicate the quality of this special steel for wheel centers. The company also had photographs, models and drawings of the "Keystone," "Player," "American" and "Ajax" trucks, Leed's pilot coupler, and several kinds of truck and body bolsters.

The Armstrong Bros. Tool Co., of Chicago, had a full line of their tool holders and their improved form of holder for extra large cutters. Their planer jacks and clamp lathe dogs were on exhibition and also the well known universal ratchet which, as everybody knows, is especially adapted to drilling holes in exceedingly cramped spaces. This firm generally goes by the name of the "tool holder people." At the convention, their excellent exhibit made them the "attention holder people."

Baltimore Railway Specialty Co., of Baltimore, were represented by Mr. T. H. Symington and by Mr. J. E. Norwood, the inventor of the Norwood center and side bearings. The claim made for these ballbearing center plate and side bearings is that they move with less friction than any other kind, resulting in less draw bar pull, less fuel, less flange wear, and less truck repairs, all round.

The Bethlehem Steel Co., at South Bethlehem, Pa., had a large display of nickel steel and carbon steel castings and forgings for locomotive use. They showed specimens of high maganese foundry pig iron and a special quality of staybolt iron, Taylor-White tool steel, malleable bronze castings, aluminium castings, forgings and shafting of all kinds, and they showed a rapid fire gun with ammunition. They also exhibited for the Shelby Steel Tool Co. non-corrosive locomotive tubes made of Bethlehem 30% nickel steel.

Brady Brass Co., of Jersey City, N. J., had specimens of their Cyprus bronze for locomotive and car bearings, also samples of ingots of Cyprus bronze, babbitt

metals, solder and metals suitable for making packing, and samples of machined locomotive castings.

The Buffalo Brake Beam Co., of Buffalo, N. Y., were represented by Mr. S. A. Crone and others. The company whose office is at 30 Pine street, New York, manufactures the Vanderbilt brake beam. The beam is simply a structural steel shape of I-section. The heads fit neatly on the ends of the beam and are held in place by one rivet each. The shape of the beam prevents the head working and the fulcrum grasping the flange of the beam in the center is securely held in place by one rivet. This latter is a malleable casting of ingenious design and neat workmanship.

The Cling Surface Mfg. Co., of Buffalo, N. Y., were also on the ground. The exhibit consisted of a machine having two pulleys on one shaft connected by belts, driving two pulleys a little distance away, each weighted to give the required tension. One of these belts was plain and the other coated with "cling surface." It was interesting to see the latter belt following the driving pulley half way down to the shaft while the other would give an occasional slip to show that it had not "caught on." A number of people were viewing this exhibit and from the sprinkling of politicians among them, it was evident that they considered the "machine" was giving an excellent exhibition of pure "pull."

The Camel Co., of Chicago, Ill., were represented by Messrs. Hopkins & Elliott. Their exhibit consisted of journal bearing and hose clamps. They also showed the Security car door, the Dunham car door, the Q. & C. car door. This company also handles the N. R. S. hose bands and the Camel journal bearing. The last straw has not been laid on the back of this journal and is not likely to be. The Camel Co. was formerly the National Railway Specialty Co.

The Carborundum Co., of Niagara Falls, N. Y., displayed a full assortment of their products, carborundum wheels, carborundum paper, carborundum cloth and carborundum grains were to be seen along with other grinding specialties. The product of the carborundum works is the nearest artificial approach to the diamond which has ever been made.

A. M. Castle & Co., of Chicago, had on exhibition a Cour depressed corrugated locomotive firebox side sheet. In this sheet a vertical depression is made along each line of staybolts and this series of corrugations gives sufficient flexibility to provide for the necessary expansion and contraction of the sheet. The claim is made that steel of lower tensile strength can be used with the same factor of safety, if the Cour method is used.

The Chicago Pneumatic Tool Company of Chicago, displayed a full assortment of their well known tools, and also gave away as a souvenir a whirling "mind-changer." This is a very ingenious toy, consisting of a small piece of wood, square section, notched along one edge, with a pin in one end upon which revolves a thin flat piece of wood. When the thumb nail is run over the notches with the forefinger on one side the thin flat bit of wood revolves in one direction, and when the second finger is pressed on the other side and the notches rubbed as before the little piece of flat wood should revolve in the other direction. The pneumatic people humorously assert that to perform the latter feat it is necessary for the operator to concentrate his mind—if he has one—upon the matter in hand, and by changing his mind succeed in altering the rotation of the little blades. Considerable merriment was produced when men holding responsible positions in the railway and mechanical world apparently proved that they had no minds. The company, however, presumed that everybody present at the convention had a mind, as they gave away their souvenir freely. In fact the pneumatic tool people went on the principal of the young divinity student, who when asked at an examination to name the minor prophets, replied that it was not for him to make invidious distinctions.

The Chicago Railway Equipment Company, of Chicago, displayed the National Hollow brake beam, also the "Diamond Special" beam for high speed service. The Kewanee, the Sterlingworth, the Monarch and the "Ninety-Six" brake beams. Automatic frictionless side bearings and the "Creco" brake slack adjuster completed the interesting exhibit, which was presided over by Mr. E. B Leigh, vice-president and general manager of the company.

The Commonwealth Steel Company, of St. Louis, had on exhibition models of the Commonwealth truck with rigid bolsters, and also with the ingenious swing arrangement by which a certain amount of lateral motion is permitted to the bolster and supporting springs. The Commonwealth Truck bolster and body bolster were represented by models, and also what is called the Separable body bolster. This bolster will permit the removal of continuous draw timbers without requiring the removal of their attaching bolts. It is made for all capacities and all styles of cars.

The Consolidated Railway Electric Lighting and Equipment Company, of New York, often described as the "Axle Light," had an exhibit which this year fairly carried away quite a number of the company's friends and well wishers. The "carrying away" was, in one sense, done

in the beautiful private Pullman car "Elysian," which took a party of railroad men and others from New York to Saratoga. Col. John T. Dickinson made a most genial host, and his guests enjoyed themselves thoroughly. This car, which had been used by President Roosevelt on his recent Western trip, was placed upon the D. & H. tracks at Saratoga and stood there as a practical demonstration of what the "Axle Light" is, and can do.

W. W. Converse & Co., of Palmer, Mass., were represented at the convention by Mr. Converse, who was engaged in explaning the merits of the Converse New Headlight Cleaner, a preparation which is guaranteed free from grit, acid or any ingredient which would injure the surface of a reflector. This headlight cleaner can be used to clean silverware, or, indeed, any metal surface, but it lays itself out with special gusto when a headlight reflector comes within its sphere of influence.

The Crane Company, of Chicago, were to the fore with their new crane locomotive muffler pop safety valve. The self-adjusting feature is considered to be a decided advantage, and the convenient outside regulator for operating the gearing for raising or lowering the adjustment ring is a thing which instantly appeals to any practical man. Gun metal globe and angle valves and blow-off valves for high pressure were also to be seen. The Crane Company had as a souvenir a very neat packet steel measuring tape contained in a nickel plated case. The tape is on one side divided into feet and inches and on the other into centimeters. The metric side of the tape is one meter long, while the other gives a distance of 36 inches.

The Crosby Steam Gauge and Valve Company, of Boston, had on exhibition locomotive steam gauges, pop valves, their ingenious spring seat globe and angle valves, Johnston blow-off cocks, air brake recorders, counters, duplex air brake gauges, indicators, chime whistles and vertical reading gauges, in which the figures are always "right side up with care" before the beholder.

The Detroit Lubricator Company, of Detroit, had an exhibit of their lubricators in one of the rooms of the Grand Union Hotel. Locomotive sight feed lubricators were shown, also the company's graphite lubricators which feed flake graphite regularly and in small quantities.

The J. A. Fay & Egan Company, of Cincinnati, exhibited photographs of their wood working machinery, and had one of their new band saws set up in their space on the hotel veranda.

The General Manifold Company, of Franklin, Pa., exhibited their various manifolding devices, also their requisition cards, defect cards, replacer cards, etc.

The Gold Car Heating & Lighting Company, of New York, had on view their car heating apparatus showing duplex coil system, and the straight steam system. These were in working order under steam. The various parts and details of their equipment were shown separately.

The Gould Car Coupler Company, of New York, showed a great variety of products, among which were their improved maleable draw gear, with spring buffer blocks for freight cars. The Gould improved coupler for 100,000-lb. cars. Improved M. C. B. journal boxes, coupler for back of tender for heavy equipment, passenger steel platform with friction buffer and draw gear. Friction draw gear for steel or wooden sills and improved roller freight car side bearings.

Mr. H. G. Hammett, of Troy, N. Y., was on the ground as usual, and had an intersting exhibit of the railroad specialties which he handles. These include the Richardson and the Allen-Richardson balanced slide valves. The Sansom bell ringer, his own ingenious link grinding apparatus, the Pendergast metallic packing, and some oil cups.

The Handy Car Equipment Company, of Chicago, had several things which are as the name implies, "handy." The Handy box car which was not shown is practicaly a gondola with box car top, with capacious doors on the side. The car can do the work of a box car or that of a gondola. The snow locomotive and car replacer and the handy swinging pilot coupler were on the ground.

Messrs. Herman, Boker & Co., of New York, were reprsented at the convention by Mr. E. Haring, who explained the properties of Novo steel and exhibited the steel and Novo steel cutters.

The Homestead Valve Manufacturing Company, of Pittsburgh, Pa., exhibited the Homestead locomotive blow-off cock, which is a very ingeniously designed valve.

The Huff Locomotive Appliances Company, of Boston, Mass., had an exhibit showing the Huff track sanding device, automatic steam blower, a variable exhaust nozzle and the Huff fuel economizer and smoke preventer.

The Illinois Maleable Iron Company, of Chicago, exhibited the Pruyn automatic smoke jack for round houses. This jack lowers on to the top of a locomotive smoke stack, and makes a satisfactory joint.

Jenkins Brothers, of New York, displayed a full assortment of their well known valves and packing. The firm was represented by Messrs. Williams, Langston and Martin.

The firm of Jerome & Elliott, of Chicago, exhibited specimens of metallic packing, both in the ordinary form and that used with piston rods, having enlarged ends. Valve stem packing was also in evidence. They exhibited the McIntosh air-operated blow-off and check valve.

The Kennicott Water Softener Company, of Chicago, displayed a water softening apparatus and photographs of the numerous installations which they have made on many of our leading railroads.

The Kindl Car Truck Company, of Chicago, showed the Kindl and the Cloud trucks, their roller side bearing and the pedestal lateral motion device, which it is claimed eliminates broken wheel flanges and minimizes rail wear.

The Lawson Dumping Boat & Car Company, of New York, had as an exhibit a very bautifully made working model of their instantaneous air-operated dump car. This car has a steel frame and carries two steel boxes, the full length of the car. These boxes rest on a series of steel balls and when desired the boxes are run out to the edge of the frame and tipped over, by appropriately placed air cylinders. The air mechanism also returns the boxes to their proper places where they are automatically locked. These cars are called and are instantaneous unloaders.

The McConway & Torley Company, of Pittsburgh, Pa., exhibited tne Janney and the Kelso couplers for freight car service and for the back of tenders. The couplers were made of malleable iron and steel.

The McCord Company, of Chicago and New York, had on view the McCord Axle box. The McKim gasket. The McCord spring dampener, and the Torrey anti-friction metal. As a souvenir this company gave away a neat little replica of their axle box, about ⅛ size, made of malleable iron and lacquered on the outside. The little axle box is intended for use as an ink well, and is a useful as well as a "'cute" desk ornament.

Manning, Maxwell & Moore, New York, displayed a number of their specialties such as the Ashcroft Company's steam gauges, Hancock inspirators, Edison recording gauges, the Consolidated Safety Valve Company's safety valves, the Metropolitan injectors and ejectors, and numerous other check valves, steam valves, strainers and pop valves muffled and plain, for use on locomotives.

Manufacturers' Railway Supply Company, of Chicago, Ill., exhibited their interlocking brake-shoes as made for cars and for driver brakes. They also exhibited the driver brake head made for the interlocking shoe. The driver brake head has only lately been put on the market.

The Mason Regulator Company, of Boston, Mass., were on the ground with a very full assortment of their steam specialties. This company manufactures steam regulating devices and steam pumps, and also a locomotive reducing valve for use on an engine in connection with the heating of cars with steam. The company also manufactures automobile appliances.

The Metal Plated Car & Lumber Company, of New York, had a section of a passenger car plated with sheet copper. The Interboro Rapid Transit Company, of New York, are having 500 cars coverd with this material, the N. Y., N. H. & H. have ordered 126 new metal plated cars. The Boston & Maine and the Erie are using this style of car, and it is growing in favor.

The Moran Flexible Joint Company, of Louisville, Ky., showed their ball joints in all its shapes and sizes for use everywhere where piping is employed. A striking feature of the exhibit was an enormous Moran flexible joint for water mains, beautifully finished.

The National Car Coupler Company, of Chicago, had examples of the Hinson draw gear and the Hinson draw bar attachment. The National freight car coupler and the National steel platform and buffer for use on passenger cars.

The National Malleable Castings Company, of Cleveland, Ohio, had an exhibit which comprised the Tower coupler as applied to locomotives made of malleable iron or steel. The National car door fastener and the National journal box were also exhibited.

The New Jersey Car Spring and Rubber Company, of Jersey City, N. J. This company had a full line of railway hose and packing, for use on a railway line.

Mr. A. O. Norton, of Boston, Mass., had a display of his well-known ball bearing jacks. These jacks are of all sizes and shapes and are used wherever there is lifting to be done. They are made in all forms and in all sizes.

The Philadelphia Pneumatic Tool Company, of Philadelphia, Pa., had a sample of very nearly all the tools they manufacture. The Keller pneumatic hammers were in evidence, and also their pneumatic holder-on. Rotary drills, breast drills, yoke riveters, and their pneumatic rammer were also to be seen. This latter tool is the one which knows enough to pound sand. The company gave away as a souvenir a neat little shopping list tablet made of aluminum. They also gave their friends a very serviceable key ring and aluminum chain with an imitation of Keller hammer as one of the links of the chain. Thus have

they sought to chain attention to the riveter, and to rivet attention to the hammer on the chain.

The Pittsburg Spring and Steel Company, of Pittsburgh, had an interesting exhibit of locomotive and car springs.

E. L. Post & Co., of New York, displayed specimens of the Post Zero Babbitt metal for use in journal bearings.

The Pyle-National Electric Headlight Company, of Chicago, had an exhibit on the D. & H. tracks, which consisted of a passenger car lighted with acetylene gas, also a headlight in operation. The Commercial Acetylene Company's safety storage system was also shown.

The Railway Appliances Company, of Chicago, had quite a display of railway appliances, among which may be mentioned the Symington journal box and dust guard, the Whall metallic window casing, the Fewing's car and engine replacer, Globe ventilators, Ajax vestibule diaphragms and the "Sanwood" car step. This company also handles the Gilman-Brown emergency knuckle.

The Railway Materials Company, of Chicago, exhibited Ferguson oil furnaces for rivet heating, flue welding and bolt heating purposes, and the Ferguson locomotive fire kindler.

The Rand Drill Company, of New York, displayed a full assortment of the Rand pneumatic tools; they also exhibited steam, electric and gas-driven air compressors.

The Republic Railway Appliance Company, of St. Louis, displayed interlocking brake shoes and driver brake head, Republic friction draw gear, Symington journal boxes and dust guards, Falls Hollow stay bolt iron and other railroad specialties.

The Safety Car Heating and Lighting Company, of New York, had an exhibit of car heating apparatus in one of the hotel cottages, all the recent improvements in the company's system were there shown, also an exhibit of car lighting apparatus showing bracket lamps and fancy deck lamps was in the usual corner of the rotunda. A buoy lantern was also shown.

The Schoen Steel Wheel Company, of Pittsburgh, Pa., exhibited some of their new solid forced and rolled car wheels. These wheels are made by a very ingenious process. Messrs. C. T. and A. E. Schoen, with Mr. M. R. Jackson, were in charge of the exhibit.

The Standard Coupler Company, of New York, had an exhibit consisting of the Sessions' Standard friction draw gear, Standard couplers and Standard steel platforms.

The Standard Paint Company, of New York, exhibited models of refrigerator cars showing methods of insulation, preservative paint for iron and steel, Ruberroid roofing and car flooring.

The T. H. Symington Company, of Baltimore, Md., had a very fine exhibit of the Symington axle box and dust guard. Mr. T. H. Symington and others represented the company.

H. B. Underwood & Co., of Philadelphia, showed catalogue of special tools, such as valve seat facers, boring bars, etc.

The U. S. Metal and Manufacturing Company, of New York, exhibited a number of railroad specialties, such as the Cliff and Giubert automatic hose reels, the Camel journal bearings, the "Johnson Hopper door" and the "Johnson flush door" for cars, the Dexter and the Dexter, Jr., brake beams, etc.

The Walworth Manufacturing Company, of Boston, had a very attractive display of steam whistles, Smith's railway track ratchet, Stilson wrenches, stocks and dies, pipe taps, pipe vices, pipe cutters and nipple holders. Ratchets of all kinds were in evidence together with Mack & Dodge injectors and Bestosking packing.

The Washburn Coupler Company, of Minneapolis, showed some flexible head passenger couplers and couplers suitable for switch engines, and a regular line of freight car couplers.

The Westinghouse Air Brake Company, of Pittsburgh, Pa., the Westinghouse Electric and Manufacturing Company, of Pittsburgh, the Westinghouse Automatic Air and Steam Coupler Company, of St. Louis, Mo., and the American Brake Company, of St. Louis, were jointly represented in one booth. Their exhibit consisted of models of railway cars equipped with the air brake for freight and passenger service, also the Westinghouse friction draw gear for freight and passenger, the automatic steam and air coupling, the automatic brake slack adjuster and the Westinghouse high speed reducing valve. Each of these companies had representatives on the ground.

Julien L. Yale & Co., of Chicago, had an exhibit of Major couplers, which was in charge of Mr. H. L. Winslow.

The Joint Committee of the Railway Master Mechanics and of the Master Car Builders' Associations will meet in New York on August 3, to decide on the next place for holding the annual conventions.

How many among us at this very hour
do forge a life-long trouble for ourselves,
by taking true for false or false for true?
—*Tennyson.*

Railway Mileage of the World.

There have been years when railroad building has been much more active in the United States than it has been any year since the present prosperous times came on, but our railroads are steadily extending and the people have no reason to apologize for the rate of increase.

The New York *Sun* recently published a letter from Walter J. Ballard which gives the railroad mileage of the world as folows:

At the end of 1901 it was 507,515 miles, and by the end of 1902 it had increased to 532,500 miles, distributed as follows:

	Miles.
United States	202,471
Europe	180,708
Asia	41,814
South America	28,654
North America (except the United States)	24,032
Australia	15,649
Africa	14,187

By chief countries the figures are:

	Miles.
United States	202,471
British Empire	91,485
German Empire	32,753
Russian Empire	31,945

The aggregate capital invested in railways is $36,850,000,000.

The mileage figures show that the United States has within 2,269 as much railroad mileage as has all Europe with the rest of North America thrown in, and 19,501 miles more than twice as much as the British Empire. We have more than six times as much as either the German or Russian Empire.

In 1902 our railways received gross earnings of $1,726,380,297, an increase over 1901 of $137,854,230, and paid out for wages $676,028,592, an increase of $65,344,891. The net earnings were $610,131,520, an increase of $52,002,753. Railway statistics since 1897 afford dead-sure testimony of American prosperity.

Recently the Lunkenheimer Company of Cincinnati, makers of brass and iron steam specialties, gave their forty-first annual "outing." Seven hundred employees and their families participated in the enjoyable excursion. There were in all about two thousand people present, including children. Everything was free —transportation, refreshments, music, etc.—the Lunkenheimer Company acting as generous hosts to their employees. Woodsdale Island Park, about thirty-one miles from Cincinnati, on the C. H. & D., was chosen as the "objective point" for the picnic, and the transportation of the holiday-makers required two trains of ten coaches each. The programme included games, with races, etc., interspersed with humorous features. The musical programme was excellent, consisting of thirty numbers, in which the delightful waltz appeared many times. The Lunkenheimer Company had the satisfaction of bringing home twenty cars of perhaps tired, but thoroughly happy people, who had had a day of amusement and social intercourse which will long be remembered.

The Joseph Dixon Crucible Company, of Jersey City, have got out a very neat little folder showing their protective paint for steel and iron. They give four samples, olive green, natural, dark red and black. These samples give a good idea of the shade of color each represents. Half-tone reproductions of photographs of buildings, bridges and chimneys which have been painted with these colors are shown, and the letter press gives a paint specification for steel and iron construction work and one for steel and iron maintenance work. Altogether the folder is very useful and it is of convenient size. The Dixon Company will be happy to send the folder to any address on receipt of a request to do so.

A very artistic catalogue has just come to us from the Railway Materials Company of Chicago. On the title page are the words "Oil as Fuel—Its advantages for railroad shops and manufacturing plants." The various types of the Ferguson oil furnace are set forth and described in the pages which follow. The first is the Ferguson flue welding furnace, then comes the rivet furnace, the bolt furnace, the four forging furnaces, the bulldozer furnace, the furnace for tapering, the spring banding furnace, the two-spring fitting furnaces, the annealing and flanging furnace, the portable heater for steel car repairs and the Ferguson portable heater and kindler for kindling locomotive fires or removing locomotive tires, straightening frames, etc. The catalogue is well printed and the line cuts and half-tones are good. There is no doubt but that the Railway Materials people can "make things hot for you," but not in an unpleasant way, they do it in a manner which produces results economically and quickly. Write to them—Old Colony Building, Chicago—for their catalogue if you wish to know all about oil furnaces.

The application of electricity as a motive power for machine shops has been an evolution rather than a revolution, and, except in special instances, its use is steadily superseding that of steam, compressed air, hydraulic, rope drive, or combinations of these powers. In the past ten years the use of electric motors in shops has risen from a few incomplete and scattered cases to the present employment of about 600,000 hp. regularly supplied by electricity. As agents in this industrial advance, the Westinghouse Electric & Manufacturing Company has taken a prominent and important place.

The Allis-Chalmers Company, of Chicago, have recently issued a partial list of users of the Reynolds Corliss engines. These machines are built by the Allis-Chalmers people. The book contains an index of cities and states, and following that is the list of electric railway and lighting concerns which use these engines and the size of the engine owned by each is given. The next list is of concerns using blowing engines and sizes of each is given. Next follows air compressors, pumping engines, rolling mills using the Reynolds engines. Also flour mills, elevators, mines, foundries, and machine shops, sawmills, woodworking shops, etc., etc. The Allis-Chalmers Company will be happy to send this list to anyone sufficiently interested to write them for it.

Gentleness, which, when it weds with manhood, makes a man.—*Tennyson.*

CONTENTS.

INDEX TO ADVERTISEMENTS.

Railway and Locomotive Engineering

Copyright by Angus Sinclair Co.– 1903

A Practical Journal of Railway Motive Power and Rolling Stock

Vol. XVI. **174 Broadway, New York, September, 1903** **No. 9**

Mr. Forney as a Newspaper Man.

In a very interesting paper which Mr. M. N. Forney read before the New York Railway Club, in 1902, there are some notes of his newspaper experience which we think worthy of reproducing. He says:

"In 1870 your lecturer became a newspaper man and then commenced editorial work on the Railroad Gazette. Previous to that he had had neither education nor training which would especially qualify him for that kind of work. Years of subsequent experience have taught him that the number of people who do not like to see themselves in print is very small. There is a fascination in seeing our ideas in type. They then appear to be entirely disassociated from ourselves. It is said that nearly all people's opinions are strengthened when others agree with them. Seeing one's thoughts presented in print somehow seems to give them additional force and authority and one then feels more confidence in them. That fascination every editor can enjoy until he makes some blunder—and they all do—and then he finds that he is not as infallible as he thought he was. This recalls a little story which perhaps you have heard from me before, but it is good enough to tell twice. A Catholic priest was passing through his kitchen one day and happened to hear his Irish cook violently berating an Italian. After the Italian or 'dago,' as she called him, had vanished, the rector felt it his duty to rebuke the cook and to remind her that Italians were people to be treated with respect, if for no other reason on her part than that the Pope himself was an Italian. 'And you know, Bridget,' said he, 'the Pope is infallible.' 'Yes,' said Bridget, 'but he would have been ten times as infalliable if he had been an Irishman.' "

"My beginning of newspaper work was doubtless like that of many another who if he had been ten times more infallible would have made fewer mistakes. There was, though, one experience that was a little peculiar. Of course, unless a person is an absolute ass, he does not expect to produce a sensation when he begins to write for the public. But even at this remote distance I can recall the curious question that came over me on discovering that apparently no one ever read what I wrote. The word 'apparently' is used advisedly, because in time the writer who works honestly and intelligently will find that here and there someone has read what he has put in print, and that if he only keeps at it and does not 'weary in well doing,' his work will produce some results according to his ability, pertinacity and mental integrity. This was illustrated in the adoption of standards by the Master Mechanics' and the Master Car Builders' Associations. In 1870 hardly

WATER TROUGH ON THE LONDON AND NORTH WESTERN RAILWAY

anything had been done in that direction. As early as 1864 the inconvenience and confusion resulting from the diversity in the screw-threads used in machines and other structures was brought up for consideration before the Franklin Institute of Philadelphia. It may be almost incredible to the younger members present to be told that at that time there was no common standard. The number of threads to an inch, their form and the diameter of screws were all made in accordance with the whims and fancies of different manufacturers or master mechanics, with the result that a ⅞-inch nut on one car or locomotive would often not screw or stay screwed on to a bolt of nominally the same size on another. This was the cause of endless confusion and loss. It would take too much time to tell the story over again of how the Franklin Institute first adopted the Sellers Standard, which was followed successively by the Navy Department, the Master Mechanics' and Master Car Builders' Associations. It may all be found in a report of the Master Car Builders' Association Convention of June, 1882. About that time as much was written on the subject as would make a book as big as the New Testament or larger. All kinds of obstacles and opposition were arrayed against the adoption of the standard, and had it not been for the commanding position occupied by the railroad companies toward the manufacturers, it is doubtful whether the standard screw-thread would have yet been generally adopted."

A Strike for Lower Wages.

Theodore Smith & Sons, boiler makers of Jersey City, have asked for police protection of non-union employees.

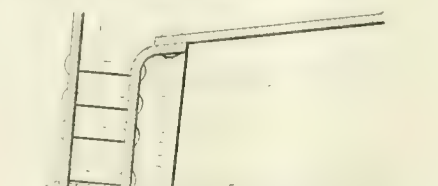
Charles Smith, one of the firm, said the strike presented a novel feature, the movement being practically an effort to bring about lower wages. The firm, he said, had always paid union rates, but they had also established the plan of paying extra wages to men who proved to be expert workmen. The union rate, he said, was $3 a day, but the firm had several men to whom they paid $3.75 a day in recognition of the better work done by them. When the International Machinists' Union learned this, the firm were notified that they must establish a uniform rate of $3 a day or a strike would be ordered. The firm refused to comply with the demand and the strike followed. The men who were getting $3.75 a day went out with the others, thus protesting against the higher wages they received. Since then the firm have employed non-union labor. —*Iron Age*

Every man ought to know his own business best.—*Mr. Wemmick.*

An Improved Locomotive Fire-Box Door Flange.

In the construction of steam boilers, and particularly those employed in locomotives, difficulty has often been experienced in preventing cracking and leakage about the door of the fire-box. The outstanding flange carried by the inner sheet is disposed substantially at right angles thereto, and the connection of the flange with the sheet is in the form of a sharp bend in the metal. It is with this portion of the structure that the difficulty is experienced, as the cracks occur along the inner bend or knuckle.

There are several reasons which cooperate to cause this damage. In the first place, the inner door sheet and flange are highly heated by the fire, but as soon as the door is opened by the fireman a great volume of cold air rushes in through the doorway. As a result the flange and knuckle are suddenly cooled, causing unequal and instantaneous contraction of the metal, thus setting up strains which tear the flange away from the sheet. This unequal expansion and contraction is furthered by the fastening of the short flanges together, these flanges thus being more rigid than the remainder of the sheets and being of smaller area they are incapable of as relatively great movement. Another objectionable feature lies in the very limited body of water which has heretofore surrounded the doorway. This space is so contracted by the overlapping flanges and the heads of the rivets fastening them that very little water can come into direct contact with the flange extending outward. Moreover, in this small space incrustation and deposits of foreign matter soon collect, thus separating the water entirely from the sheet and permitting the metal to become overheated, thereby assisting in doing the injury above described.



EXPANSION FIRE-BOX DOOR.

Information that I lately received from foreman boiler makers who have charge of boiler shops in the western and northwestern portions of the country indicates that they are having a great deal of trouble with the door flanges by cracking, and they describe it as "the meanest leak and the hardest to keep tight of any leak about a fire box."

It is the object of my improvement to entirely eliminate this objectionable feature by providing an improved structure which will freely expand and contract without causing undue strain, and at the same time obtaining a sufficiently enlarged water chamber about the doorway to prevent to a very great degree accumulations therein.

The structure by which these objects are obtained is simple and is not more expensive that that heretofore employed. Instead of the usual sharp bend or knuckle between the flange and the inner sheet, the portion of the metal connecting the flange and sheet is inwardly swelled, thus forming a circular and inwardly convexed boss about the door opening. As a result, an enlarged water chamber is provided which entirely surrounds the opening.

While it will be apparent that this change does not involve any radical departure from the usual construction and that it can be easily made without additional expense, the advantages which are obtained are very important. In the first place there is no comparatively sharp bend in the metal, while additional area is obtained. As a result, when the flange is cooled during the inrush of cold air in the manner above described, the swelled portion can freely contract without any danger of cracking, as the pronounced curve in the inner sheet gives freely to the strain. A number of benefits are derived from the enlarged water space. The comparatively large body of heated water tends to maintain a more even temperature of the metal, preventing to a great extent its being overheated and also tending to preclude the too rapid cooling of the flanges. Furthermore it provides more room about the inner heads of the rivets and in this enlarged chamber there is not so much danger of the sediment accumulating and separating the water from the flanges.

This feature is, therefore, of special importance in locomotives running in bad water districts. Actual experience on a Fremont, Elkhorn & Missouri Valley locomotive has proved that the structure is entirely practicable and satisfactory.

While the invention as described is particularly useful in locomotive boilers, it will be readily understood by those skilled in the art that it is applicable to boilers of different types and hence is not limited to any one class.

In forming the improved door flange to position I would recommend that in the large shops where power can be applied that it be pressed to position by using male and female blocks, but in the absence of these facilities it can be easily made by using the swelled cast iron former and wooden mauls. Steel hammers or sledges should never be used on a door sheet flange.

M. O'Connor.

Foreman Boilermaker C. & N. W. R. R. Shops, Mo. Valley, Iowa.

The balanced compound locomotives recently built by the Baldwin Locomotive Works for the Atchison, Topeka & Santa Fé Railway system, which were illustrated in our August issue, have steel crank axles which were imported from England. The Bethlehem Steel Company is the only concern in the United States that have facilities for making such articles, and they asked such a high price for them that it was cheaper to pay the high duty and import the axles from England. Yet there is no doubt that American steel makers can produce their goods cheaper than any steel making concern in the world, but they are not contented with ordinary profits.

Fast Baldwin Passenger Engine for the Norfolk & Western.

The Norfolk & Western Railway have recently bought some simple 4-4-2 engines from the Baldwin Locomotive Works of Philadelphia. The cylinders of these engines are 19x28 ins. and the driving wheels are 79 ins. diameter. The total weight of the machine is 168,650 lbs. and there are 85,790 lbs. carried by the drivers. The valve motion is indirect with transmission bar curved below the forward driving axle. The rocker-arm works the valve rod by means of a small crosshead arrangement as the rod passes through a guide in the yoke. The valve is of the balanced piston type and placed immediately over the cylinder whose steam distribution it governs. The diameter of the carrying wheels is 50 ins. and they are equalized with the rear drivers by means of what may be called a box equalizer in which a semi-elliptic spring is placed, the upper side of the spring buckle acting as the fulcrum for the equalizer. With this arrangement it is possible to readjust the weight on the drivers by temporarily lifting the engine and moving the spring forward or back in the "box," within certain restricted limits. The drivers are, of course, equalized together. Every wheel under the engine is braked.

The boiler is of the ordinary wagon top type with wide firebox. The smallest ring measures 62 ins. in diameter. There are 326 tubes, 16 ft. long, which give a heating surface of 2,716¾ sq. ft. when the 162 sq. ft. in the firebox are added to this, it gives a total of 2,878¾ sq. ft. The roof sheet is level, while the crown sheet slopes slightly to the back, and there is ample steam space. There is a 3½ in. hand hole in the bottom of the first barrel course nearly straight below the point of entrance of the injector delivery pipe, through which, when washing out, the deposit which necessarily forms in this region may be easily removed.

The tender has a 6,000 gallon tank which is carried on a steel channel frame, the whole carried on two arch bar trucks. The total weight of engine and tender is about 289,000 lbs., and the total wheelbase of both together is 53 ft. 9½ ins. An electric headlight illuminates the track at night ahead of this modern high-speed machine.

A few of the principal dimensions are as follows:

Cylinders—[illegible] in.

Boiler—Dia., [illegible] in.; thickness of sheets, [illegible] in.; working pressure, [illegible] lbs.; staying, radial.

Firebox—Length, [illegible] in.; width, [illegible] in.; depth front, 72¾ in.; back, 61⅝ in.; thickness of sheets, sides, ⅜ in.; back, ½ in.; crown, ⅜ in.; tube, [illegible] in.; water space, front, [illegible] in.; sides, [illegible] in.; back, 4 in.

Heating surface—Firebox, 162 sq. ft.; total, [illegible] sq. ft.; grate area, 45.1 sq. ft.

Driv. wheels—Dia. outside, 79 in.; jour., 8½ x 10 [illegible] in.

Wheel base—Driving, [illegible] ft. [illegible] in.; rigid, [illegible] ft. [illegible] in.; total engine, 26 ft. 8½ in.; total engine and tender, 53 ft. 9½ in.

Weight—On driving wheels, 85,790 lbs.; on truck, front, 39,480 lbs.; on carrying wheels, 43,380 lbs.

BALDWIN 4-4-2 ENGINE FOR THE NORFOLK & WESTERN.

Seeking Russian Markets for Locomotives.

Vice-President Robert J. Gross, of the American Locomotive Company, is now in Russia exploiting the advantages of American locomotives for operation on Russian railroads. American locomotives have been used in that country for a good many years, and with general satisfaction, but at the same time German locomotives have been more largely used because of the nearness of the German manufacturers. The American Locomotive Company, however, has decided to make a thorough study of conditions that exist in Russia, and is de-

termined to enter the field, if conditions will warrant, and this accounts for the present mission of Vice-President Gross. Incidentally, it may be stated that the company has no expectation of doing business immediately with the Russian railroads, for the reason that they have about all the orders they can care for for many months ahead for the American railroads, but the company is figuring on the future, when home orders may possibly show a decrease.

Growth of the Locomotive.

BY ANGUS SINCLAIR.

(*Continued from page 352.*)

The first decade of railroad history was one of the most critical periods the United States had passed through. It opened up with the people unusually prosperous and with money to devote to internal improvements. In 1833 President Jackson ordered an accumulation of money stored in the United States Bank, amouning to forty millions of dollars, to be distributed among state banks. These banks loaned the money, so unexpectedly obtained, on all kinds of doubtful securities, and a wild season of speculation arose. The purchase and sale of lands belonging to the public domain was the principal object of speculation and incidentally the construction of railroads was worked up to a highly inflated degree.

A RAILROAD MANIA PUSHES RAILROAD CONSTRUCTION.

A decided railroad mania prevailed, which was overtaken by the inevitable panic the following year, in 1836. In 1830 there were 23 miles of railroad in the whole of the United States.

The following table shows the mileage of railroads in operation or under construction in the different states in 1836:

	Miles.
Alabama, under construction	62
Delaware, in operation	17
Georgia, in operation	12
Kentucky, in operation	85
Louisiana, in operation	5
Maryland, in operation	144
Maryland, under construction	70
Massachusetts, in operation	72
Mississippi, in operation	26
New Jersey, in operation	105
New York, in operation	70
New York, under construction	200
Pennsylvania, under construction	234
Pennsylvania, in operation	392
Rhode Island, under construction	46
South Carolina, in operation	136
Virginia, in operation	195
Virginia, under construction	86

These figures show that nearly two thousand miles of railroad had been built in six years, a most extraordinary achievement for a new country.

RAILROAD MILEAGE EXCEEDS THE NECESSARY POWER.

The progress of railroad building in the United States, as compared with that of Great Britain, conveys a good idea of the energy displayed by American public men in pushing improved methods of land transportation. In 1840 Great Britain, with what was then unparalleled financial resources, had 3,430 miles of railroads and the United States had 2,755 miles. For this mileage, the United States, however, had only 270 locomotives, the small amount of motive power being due in some measure to the high price of locomotives and difficulty in obtaining them. A considerable part of the mileage was operated by horses, which were the first form of motive power used, and they were slowly being pushed aside by the locomotive, just as they have of late been pushed aside in street car service by electric traction.

JOSEPH HARRISON.

BRITAIN THE WORKSHOP OF EARLY LOCOMOTIVE BUILDING.

As the principal center for the building of machinery at this time was Great Britain, American railroad companies naturally imported from that country the locomotives which they could not have built at home, and there was at first an idea that foreign built locomotives must necessarily be better than the home-made article. In Wood's Treatise on Railways, published in 1838, particulars are given of sixteen locomotives which had been built by the Stephensons for American railways, and there were other makers who found the United States a profitable market. Edward Bury's first engine, built in 1831, was sold to the Petersburg Railroad of Virginia, where it was long known as the "Spitfire," and the firm, Bury, Curtis & Kennedy, built several engines for Southern railroads, and the first engine owned by the Boston and Providence Railroad was made in the Bury shops.

SHORTCOMINGS OF BRITISH BUILT LOCOMOTIVES.

British-made locomotives were a very short time running on American railroads, before the locomotive engineers began to make unfavorable comparisons between them and those made in the United States. The unique privilege which American locomotive engineers enjoyed for many years, of criticising the designs and working of their engines, soon closed the United States market for British locomotives and stimulated native machine shop owners to enter the field of locomotive construction.

The principal fault found with the English locomotives was that they were inconvenient to handle and to repair, the latter being a very serious objection when the principal part of the repair work had to be done by the enginemen themselves. The annual expense of repairing the Stephenson locomotives on the Liverpool and Manchester Railway was enormous. In 1833 the cost of keeping thirty engines in repair was about $140,000, and ten of the engines were reported to be useless. As the mileage made by each engine did not exceed 10,000 miles a year the cost of repairs alone was about 47 cents a mile.

American railroad companies were not disposed to rival that kind of extravagance.

The British locomotive builders did not heed suggestions, that changes might easily be effected which would make their engines more reliable for continuous mileage, more convenient to repair and to handle; so they lost the American market for locomotives in a very few years, just as other British manufacturers lost the American market for axes, because they would not make the axes of the shape demanded by the users.

GARRETT & EASTWICK BEGIN LOCOMOTIVE BUILDING.

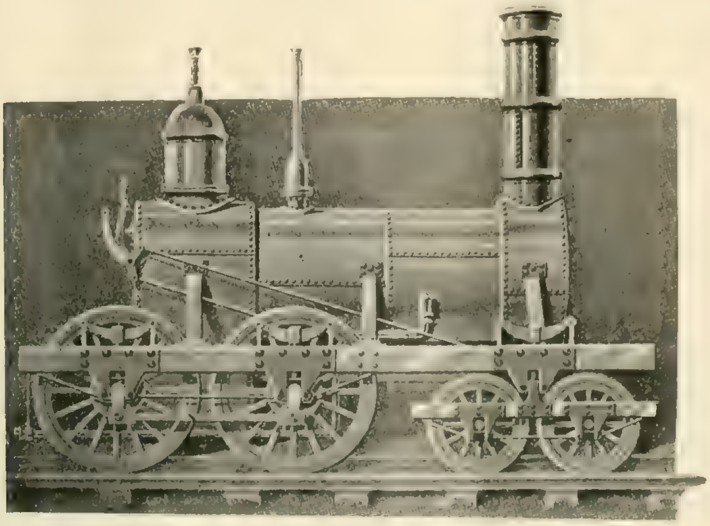
There were soon going to be plenty of competition in the business of locomotive building. In 1835, the year after Mr. Baldwin entered seriously into the work of locomotive building, the firm of Garrett & Eastwick, then making steam engines and light machinery, in Philadelphia, obtained an order to build a locomotive for the Beaver Meadow Railroad, the first section of what is now a branch of the Lehigh Valley Railroad.

THE BEAVER MEADOW RAILROAD.

The Beaver Meadow Railroad winded about the mountains and forests of the Mauch Chunk region, and was originally built for the transportation of coal for shipment on the Lehigh Canal. The construction of the line was a great enterprise as it involved the overcoming of greater engineering difficulties than anything previously encountered in railroad building. When finished the road was

exceedingly crooked and hilly. It had one curve 300 feet long of 250 feet radius; there were two grades 96 feet to the mile, three-quarters of a mile each, and one grade 80 feet to the mile, five miles long, having several curves, one of them being 550 feet radius.

The capitalists who undertook the construction of that railroad were leaders among the most enterprising gentlemen in Pennsylvania at that time. They spared no expense to make the railroad and its equipment equal to the best that could be procured at that period.



FIRST 8-WHEEL ENGINE. FIG. 32.

EASTWICK & HARRISON'S FIRST ENGINE.

The Beaver Meadow locomotive was called the "Samuel D. Ingham," after the president of the road. The engine had the Bury boiler and inside frames with outside cylinders, a style of construction that had up to that time found very little favor from locomotive designers. The reversing gear invented by Andrew M. Eastwick was entirely original, and consisted principally of a sliding block intervening between the valve seat and the slide valve. Particulars will be given in my article on locomotive valve gear.

JOSEPH HARRISON, JR.

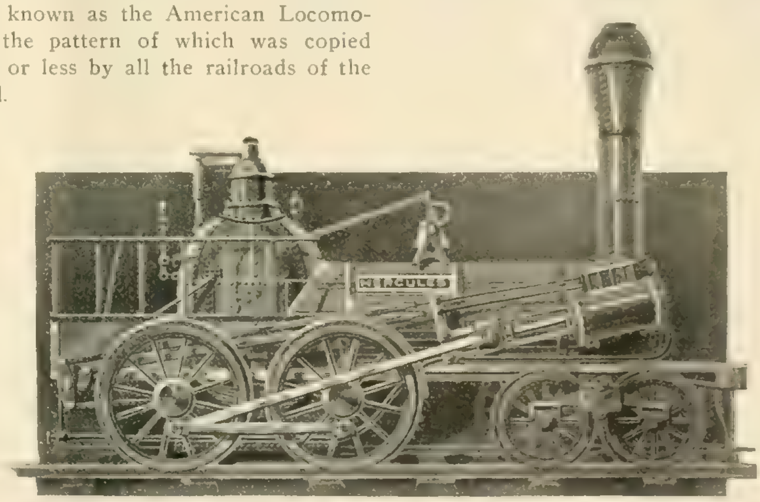
As Garrett & Eastwick had no experience in locomotive building, they engaged as foreman, Joseph Harrison, Jr., a young man who had worked for several years in the Norris Works, where he learned a great deal from the failures and a little from the successes in locomotive building. Harrison developed into an excellent designer of locomotives, and he invented a variety of improvements which became permanent features of the locomotive engine.

THE FIRST CAB.

The "Samuel D. Ingham" compared favorably with any locomotives then in use. The engine was noteworthy as being the first built with the deck covered to afford protection of the enginemen. It is said to have been a very crude cab, but it was a beginning of a very desirable improvement, that was soon acknowledged to be an absolute necessity for locomotives operating in the rigorous climate of the United States.

THE FIRST EIGHT-WHEEL ENGINE.

Early in 1836, Henry R. Campbell, a civil engineer on the Philadelphia and Germantown Railroad, secured a patent on an eight-wheel engine, Fig. 32, with one pair of driving wheels in front of the fire box and the other pair behind. It was the first of what afterwards became known as the American Locomotive, the pattern of which was copied more or less by all the railroads of the world.



EASTWICK & HARRISON'S FIRST ENGINE WITH FLEXIBLE FRAME. FIG. 33.

In designing his engine, Campbell was influenced by the desire to produce a locomotive that would be easy on the tender track. Strap rails laid on wooden stringers were still the rule, and the Beaver Meadow road, recently opened, was considered particularly substantial with strap rails $2\frac{1}{2}$x$\frac{5}{8}$ inch.

The tendency towards the building of light railroads was due more to the poverty of the country than to want of foresight on the part of our railroad builders. The native furnaces could not produce but a small fraction of the iron needed for rails, and the import duty was about $25 a ton. As the building of a railroad provided with substantial rails was out of the question, the pioneer builders did their best with the material at their command.

One engine was built after Campbell's drawings in a shop in Philadelphia belonging to James Brooks & Co., and it was put to work on the Philadelphia and Germantown Railroad, but did not become popular. The principal objection to it was that it rode hard, due to the want of means for equalizing the weight on drivers.

GARRETT & EASTWICK'S HERCULES.

Late in 1836 the firm of Garrett & Eastwick built an eight-wheeler called "Hercules" (Fig. 33), for the Beaver Meadow Railroad, in which an attempt was made to render the engine more flexible. Mr. Eastwick devised a separate frame with pedestals, in which the two pairs of wheels were placed. This frame vibrated upon the center bearing, and could move as the truck does, except that it could not turn. This allowed it to adjust itself to uneven track, provided the unevenness was alike on both sides, otherwise it racked the framing. This frame was underneath, and separated from the main frame by side bearing springs. This was better than the old rigid plan of Campbell's, but not very much better. This engine "Hercules" was the first one to have bolted straps and half-boxes on the side rods, instead of a gib and key; the rods had no keys.

The "Hercules" weighed fifteen tons, and was to run on a very crooked and hilly road. This engine was so flexible that it could accomplish more work than the others in use, and more like it were ordered. But in the meantime, the firm took into partnership Joseph Harrison, Jr., their young foreman, who set about simplifying the flexible engine; and the

result was the invention of the modern equalizer, now universally used in this country and in most foreign countries.

THE FIRST EQUALIZERS.

Harrison's first equalizers were made of cast iron, very heavy and clumsy and were hung above the frame just as they are now in 8-wheelers, the ends bearing on round pins that went down and rested on the top of the box. Mr. Harrison's patent covered all the combinations of equalizers now known, and also provided one for the truck. This device made it possible to use any number of driving wheels on the roughest track, and was, up to that time, the most useful improvement made on the locomotive engine.

EQUALIZERS DISCREDITED.

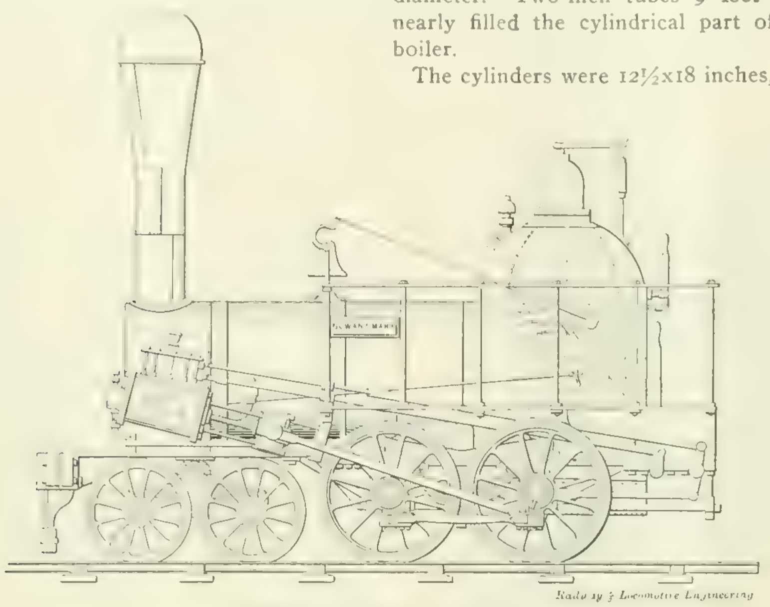
The other builders condemned the use of more than one pair of driving wheels, and did not, for some time, credit the equalizer with any merit. Mr. Baldwin said he could not see how the engine would curve without slipping some of the drivers, and he thought it impossible to maintain all four wheels exactly the same size and thought them complicated; but their good points were forced upon him by their service, and, in 1845, he bought the patent of Mr. Campbell's 8-wheeler, and that of the equalizer of Eastwick & Harrison, and at once turned out his first class "C" engine, and afterwards said she was the best engine he had then turned out.

THE "GOWAN & MARX."

In 1839, Eastwick & Harrison, as the firm was now called, received an order from the Philadelphia and Reading Railroad for a big locomotive to weigh all of eleven tons, not less than nine tons to be on the four drivers, and it was specified that the engine must burn anthracite coal in a horizontal boiler. The engine built upon this order was known as the "Gowan & Marx" (Fig. 34), which became one of the most famous locomotives ever built.

The engine was of the eight wheel type, and in order to properly distribute the weight, the rear axle was placed under the firebox, just as it is now placed under six and eight coupled engines. The boiler had a Bury dome firebox 5 feet diameter. Two-inch tubes 9 feet long nearly filled the cylindrical part of the boiler.

The cylinders were 12½x18 inches, and the driving wheels were 42 inches diameter. A blower for stimulating the fire was first used on this engine, and it was the first to be equipped with Harrison's equalizers.



GOWAN & MARX. FIG. 34.

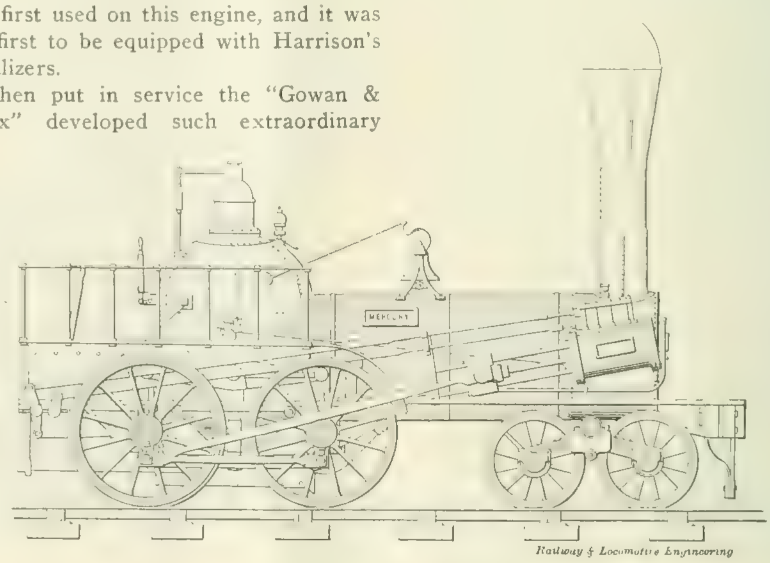
When put in service the "Gowan & Marx" developed such extraordinary tractive power that the whole railroad would become interested and many individuals were incredulous. On one of its first trips in February, 1840, it hauled from Reading to Philadelphia a train of 104 4-wheel loaded cars, at an average speed of 9.82 miles per hour. The road had a descending gradient of nearly 4 feet per mile, 27 miles level, 9 miles of it in one place, and only one ascending grade, 26.4 per mile for 2,100 feet. This train weighed 423 tons, and, including the weight of engine and tender, equalled *forty* times the weight of the engine.

In connection with the great amount of tractive power developed by the "Gowan & Marx," in proportion to its weight (forty times its own weight), it is curious to note that only ten years earlier, the Liverpool and Manchester Railway Company, in offering a prize of five hundred pounds for a practicable locomotive, required that it should pull *three* times its own weight. The South Carolina Railroad Company, in ordering a locomotive from the West Point Foundry, in 1830, also specified that it must pull a train three times the weight of the engine.

The success of the "Gowan & Marx" promised to promote rapidly the business of the builders, but the personal good fortune brought to the firm deprived the United States of good locomotive manufacturers.

The remarkable performances of the engine attracted much attention at home and abroad. The Russian Government, on account of the work done by this engine, sent two engineers to the United States to verify the account and to report on the best machinery and appliances for the St. Petersburg and Moscow Railway, then under construction.

The report of these engines was so favorable that Eastwick & Harrison were requested to visit St. Petersburg, with the view of making a contract for building locomotives and cars. The contract was made and the Americans established locomotive building works in Russia and shortly afterwards closed up their works in Philadelphia.



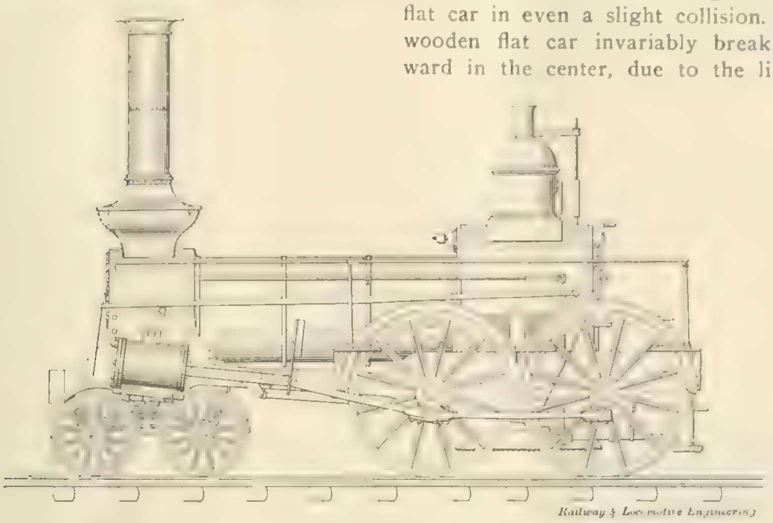
MERCURY. FIG. 35.

Before closing their works for good, Eastwick & Harrison built two passenger engines for the Baltimore & Ohio, which were as notable for fast speed as the "Gowan & Marx" was for load pulling. One of these, the "Mercury" (Fig. 35),

in 1844 worked the great aggregate of 37,000 miles, the greatest annual mileage achieved by one engine up to that time.

Why Steel Cars Are Popular.

The Bessemer & Lake Erie Railroad were the first to adopt the steel car of large capacity and that was in 1897. An



EIGHT-WHEELER BUILT BY EASTWICK & HARRISON, FOR RUSSIA.

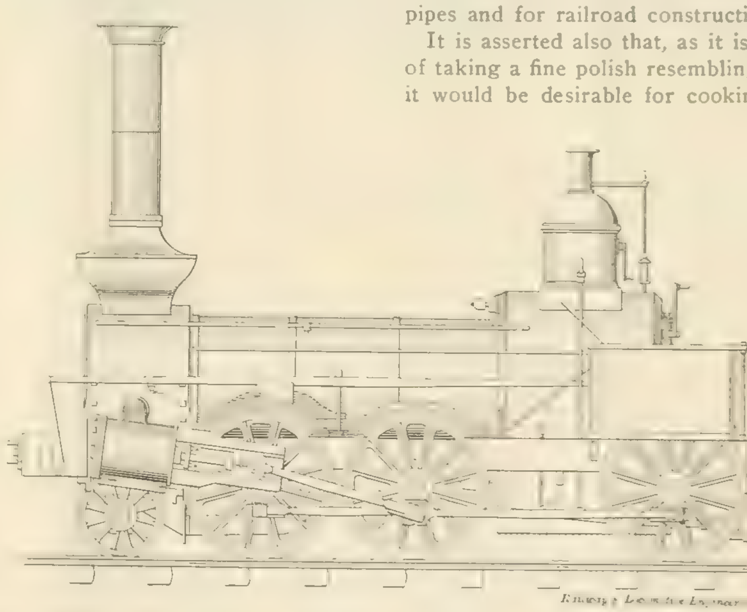
estimate made about the middle of this year places the number of big tonnage steel cars now in this country at over 100,000 cars.

There are several reasons why the popularity of the steel car has increased and that of the wooden car has diminished, in the railway world, but perhaps the most cogent reason for the preference given to steel cars is the fact that considering the total load behind the tender in any train, the dead weight hauled will be less if the train be made up of high capacity steel cars. That being the case it follows that fewer cars will be required per 1,000 tons of freight with a consequent reduction of light mileage.

These two reasons taken in conjunction with the fact that steel cars are more durable than wooden ones, has brought about a reluctance on the part of interchanging lines to haul old light wooden cars in trains of heavy high capacity steel cars. The large high-side hopper car also possesses very great advantages in the matter of handling rough freight, as the majority of such cars are loaded by mechanical means and are dumped quite easily through their drop-doors. The steel car while holding a much greater load than the wooden car, with less dead weight on the wheels in proportion to load carried, nevertheless occupies practically the same track space which its predecessor required, and the advent and increasing use of the steel car does not necessitate longer sidings or more of them to be introduced on railways.

Another interesting feature about steel cars or cars with steel frames is that it enables the draw gear to be put on the center line of pull and not kept altogether below the center sills, as is required in wooden cars. That this is a thoroughly correct and scientific method of construction has no doubt been proved conclusively to anyone who has seen the behavior of a light wooden flat car in even a slight collision. The wooden flat car invariably breaks upward in the center, due to the line of thrust being below the sills and this tendency to break upward is assisted by the slight camber produced by the tension of the truss rods.

The steel car, however, is uncertain in one particular, and this uncertainty can only be eliminated by the lapse of



FIRST MOGUL EVER BUILT. MADE BY EASTWICK & HARRISON, FOR RUSSIA

time. The steel car has not been long enough "in our midst" to enable owners and builders to determine what are the cumulative effects of wear and tear and of corrosion and rust, but this uncertainty which is bound to be cleared up sometime in the future does not appear to have so far handicapped the steel car in its career of usefulness.

Schmidt Superheater Performance.

Through the courtesy of Mr. E. A. Williams, superintendent of rolling stock of the Canadian Pacific Railway, we have received a very interesting tabulated comparison of the performance of locomotives in freight service on the Smith's Falls—Outremont section of the O. & Q. division of the C. P. R.

An engine was fitted with the Schmidt superheater and her performance was compared with the average performance of simple and compound engines on this section and in the same service. It is interesting to note how in the contest the "fortune of war" sometimes favored one of the contestants and sometimes another, but the result which the eighteen months' test brought out was that the Schmidt superheater engine showed a saving of 33.3 per cent. over the simple engine and 13.8 per cent. over the compound. This performance makes the men on the road speak enthusiastically about engine 546 whenever the subject is brought up.

A New Metal Called Selium.

A Washington dispatch tells of the discovery in Germany of a new metal called selium by Edward Mollard, a Frenchman, which is reported to the State Department. The discoverer asserts that selium costs only one-twelfth as much as aluminum and is lighter and stronger. It does not rust and is therefore suitable for shipbuilding, for the manufacture of pipes and for railroad construction.

It is asserted also that, as it is capable of taking a fine polish resembling nickel, it would be desirable for cooking utensils. Its hardness is not quite equal to that of iron, but is greater than that of lead or zinc. Its power of resistance is said to be greater than that of iron, but less than that of steel.

Reports of this kind have to be largely discounted, but if this one is nearly correct a very important discovery has been made.

De Glehn Locomotive for Pennsylvania Railroad.

The Pennsylvania Railroad Company may be depended upon to find out the merits of any improvements in railroad machinery, no matter where it is to be found. The latest news is that they have ordered a De Glehn locomotive from France.

Pennsylvania officers said that there was no special significance attached to the order beyond the fact that the Company wished to try on its tracks a locomotive which has the reputation of being the best made in Europe. The Pennsylvania regards the American locomotive as a world beater, but wishes to see what a foreign exhibit can do over its rails and roadbed.

The Pennsylvania's first French locomotive will reach here early next year.

It will be given a test, and then made a part of the Pennsylvania's exhibit at St. Louis. After the close of the Exposition the locomotive will be placed on the road for regular runs, when it will be carefully tested to determine the uniformity of draw bar pull and the capacity for maintaining immense tractive power at high speed. Tests will also be made to determine the uniformity in rail pressure due to the balanced engine, as well as its economy in coal and water consumption.

Inspection Engine on the L. S. & M. S.

The Lake Shore and Michigan Southern Railway are using a very handy inspection engine. We are indebted to Mr. H. F. Ball, superintendent of motive power, for the photograph from which our illustration was made. The machine consists of an ordinary 8-wheel locomotive which is housed over with a car-like cab. The cylinders are 17x24 ins. and the drivers 62 ins. The weight is about 80,000 lbs., of which 53,000 are on the drivers. The steam pressure is 150 lbs. The engine belongs to class Q on the L. S. & M. S.

There is no division between the engineer's place and that of the inspection party. The floor, which is practically an enlarged running board, is about 22 ins. wide, and extends from the back of the boiler to the smokebox. Over the steam chest and cylinder, on each side a winding stairway with brass hand rails curves up to the door. The smokestack is carried up through the sloping platform hood, which has the advantage of giving the engine a long stack as well as throwing smoke and steam high in air, even when running shut off.

A novel feature which may be seen in the engraving is the tender, which is of ordinary construction, entirely hooded over with a sort of turtleback top. The central portion, however, is made with hinges and can be opened up when it is necessary to take coal. The bell is placed on top of the tank near the manhole. A 10-inch steel channel frame carries the tank. There is also the Lake Shore standard water scoop apparatus, with pneumatic operating and locking device for high speed service.

LAKE SHORE INSPECTION ENGINE

Defends American Locomotives.

James H. Worman, Consul General at Munich, refutes statements in the German press depreciating the American locomotive in these words:

"The German papers have recently been circulating the report, and it has even gained currency in the English press, that the locomotives which have been purchased in America by the Bavarian state railways within the last three years had proven unsatisfactory, and that their durability had been called into question. In these reports it is also asserted that experts had declared that the American locomotives could only last at best from eight to ten years, while the locomotives manufactured in Bavaria had stood service for thirty years, and that for these reasons, as well as because of frequent necessary repairs, the further use of American locomotives had been abandoned.

"From official sources the information is obtained that these reports are unauthorized and wholly groundless. The facts are that the locomotives which had been bought in order to study the American system of locomotive building have proven, because of their simplicity, their originality of construction, and their remarkable locomotion for fast and freight trains, most acceptable, especially as to durability and efficiency, and that up to this time nothing has been discovered to warrant a statement that, with the same care bestowed upon them as upon the Bavarian locomotives, the American locomotives would prove less durable than those built here. Indeed, many of the parts of construction have been found so simple and practicable that they will be adopted in the construction of Bavarian locomotives."

A Car With a History.

Lying in the yards of the Lake Erie & Western Railway at Peru, Ind., dismantled of its trucks, and used as a paint shop and store house for car inspectors, is an old car with a remarkable history. It is one of the old-fashioned kind, with small, high and narrow windows, and an upper deck, the sort of a sleeping car in use forty years ago. The interior decorations, especially the painting, is on an elaborate scale with gaudiness far beyond that generally seen in those days. Underneath the coats of paint that have since been put on can plainly be seen the initials, "B. & O., No. 1." It was the first sleeping car used in the West and formed a part of the funeral train of President Lincoln.

The original owners of the car were the Baltimore & Ohio. From that line it was purchased by the Pennsylvania Company, and later it went to the old Indianapolis, Peru & Chicago, now merged into the Lake Erie & Western. It was used by the latter road as a pay car for years. The car is now 42 years old. It has occupied its present position for the last fifteen years, and is yet in a good state of preservation.

The proper place for this car would be in the Field Museum, Chicago. Some corner could surely be found for it, where people interested in its history could look upon it.

The bright orange color of the Big Four trains has long attracted general attention to them in all the cities they enter. It has been in use for so many years that few employees of the company can recall when it was not the standard color of the company for Big Four coaches. But this is going to be changed. An order has gone forth that all passenger car equipment must in future be painted the somber Pullman color

General Correspondence.

Plugging Broken Stay Bolts.

It's surprising to note that some of our railroads in these days of high boiler pressures will persist in the criminal practice of plugging up the holes in drilled stay bolts that have been broken in service, rather than make immediate repairs. This is generally put off until the boiler is washed out, which may mean several weeks or a month, according to the water used. Not only is such work criminal, but it destroys the object for which the drilled bolt was adopted. Experience has taught that it is impossible even with an expert to locate broken bolts at all times, and it is due to this that the drilled bolt has been adopted. At best it is only a makeshift. The drilling is generally done by inexperienced labor and a large percentage of the holes are found away from the center of the bolt, which naturally weakens it. If it is done by the piecework system and no inspector around, cases have been found where the hole did not penetrate the thickness of the boiler shell. Adopting rules and furnishing special charts for the guidance of those whose duty it is to watch the broken bolts, is a waste of time and money unless the rule is rigidly enforced. We are not quoting from hearsay, but are giving facts as we found them. On one road we counted 36 broken bolts on a Mogul that had not seen a year's service. Wire nails and file points were used. The engineer claimed that he reported them and that the boilermaker had used the file ends in the absence of wire nails, the nails he had put in himself, taking his lesson from the boilermaker who made repairs that way. The M.M. said these engines always came in at night and got out again before morning, so that the work could not be done, as he had no night force to do this work. With the hollow bolt plugging is out of the question. If a plug is inserted from the outside, to prevent the annoying escape of steam and water, it simply drives it into the fire box, which means death to the fire. We do not believe that the parties guilty of these practices do so with any criminal intent, but it behooves the management to watch this more closely. Life and property is at stake, and certainly the crews that man these engines are due every consideration. This practice of having boiler insurance companies that make a specialty of this sort of risk do this work is a commendable one.

When the inevitable explosion happens to boilers whose broken stay bolts have given due and timely warning that was disregarded men will hold up their hands and say that the cause of the accident was a mystery. Then others interested in having the owners of the locomotive escape the penalty of the reckless practice of plugging leaky stay bolts will look wise and say that the accident was due to low water, and the engineer who was in charge having ended his life with the explosion, no one can for a certainty defend his professional character, and so he is blamed for carelessness, and the company escapes paying heavy damages.

J. A. B.

Facts About Peru.

Inquiries which reach me, from time to time, show that many erroneous impressions have existed till recently as to Peru (at least in Europe), not merely in regard to the political, financial and economic situation in the Republic, but also in respect of its physical characteristics.

Peru is often spoken of as the "Little Republic." Relatively to the United States of North America that is true; but the fact remains that Peru has an area approximately six times that of the United Kingdom of Great Britain and Ireland, or three and a half times that of Germany.

What the Republic needs is more population, the density of which is as 1 to 70 compared with that of Great Britain and Ireland, and as 1 to 60 compared with that of Germany; more industrial and agricultural activity for which the opportunities are many and immense, and more capital employed in developing the natural riches so plentifully bestowed upon it.

The emigrant who needs to choose his climate cannot fail to find in Peru a settlement fitting his requirements at any part of the temperature scale; enterprising manufacturers may find there facilities for the employment of their skill unrivalled in any other State; the capitalist has magnificent opportunities for the investment of his wealth, and its profitable employment.

Peru also offers exceptional opportunities to scholarly gentlemen, with a little capital to establish more private colleges and schools for the study of the English language.

Politically considered, Peru offers every security which accompanies stability of purpose, and a wide franchise; in municipal and taxation matters there is elasticity, and—to suit the needs of young industries—generosity, while in respect of personal liberty, there are constitutional guarantees unsurpassed for their effectiveness and comprehensiveness.

It would cause me to trespass too much upon your valuable space to justify by chapter and verse these generalizations, but if they excite the interest of some of your readers, through your courtesy in giving publicity to this letter, may I also be permitted to say that I shall be happy to forward an up-to-date map and sketch of Peru, to any persons who may furnish me with their names and addresses.

EDUARDO HIGGINSON,
Consulado Del Peru, Consul.
Southampton, England.

Defects of Cast Iron Wheels and How to Inspect for Them.

The cast iron wheel, the most common wheel in use in passenger and freight cars, as well as engine tenders, is something that requires close attention by men of experience.

Cast iron wheels are often found cracked in hub, from wheel-fit outward, and this defect should be carefully watched for on new cars and on new wheels, as well as old, for while in fitting, the wheel may stand the required pressure, it may burst or crack soon after being put into service. Re-fit or second hand wheels crack in wheel-fit or hub, more frequently than do wheels from first fitting. When wheels crack in hub, the pressure is relieved to a certain extent and they are often found loose on axle. As a usual thing, the hub of a wheel will be found cracked on one side only, but they are often cracked from wheel-fit outward on opposite sides of wheel, with cracks extending entirely out to tread, thus requiring only a slight side pressure on a curve or passing over a frog to cause them to break. This defect is more readily discovered by inside inspection of hub of wheel.

Cracked plate is a defect that is most commonly detected by outside inspection. Where the wheel plate is clean, it is easily detected, when covered with dust and dirt it is more difficult. Cracks in wheel plates are more commonly found in outside plates only, and are located in or near the disk of wheel. It is therefore very necessary to watch closely the outside plates of wheels, bearing in mind the indication in the collection of dust on the wheel. The inside plates may be cracked when the outside plates show no indication, but they are not found as frequently as the outside plate is.

In the inspection of wheels for this defect, the inspector should watch closely the wheels on opposite side of car, as he might detect a defect in a wheel that

would be overlooked by the other inspector.

Cracked tread, in nearly all cases, is caused by wheels being worn through chill and hollow, and is a very dangerous defect. As only about two-thirds of the tread and flange of a wheel can be seen, while cars are standing, the inspector should watch and listen closely for worn wheels while cars are rolling into yards and in case of wheels being worn hollow, they should make close inside inspection to see that tread is not broken through. In most cases where the tread of a wheel is cracked, one or more brackets will be found also, therefore the inspector should not fail to see all the brackets and closely inspect for indications of cracked tread. Wheels are seldom ever found with cracked brackets, unless the plate or tread is cracked, but such is sometimes the case.

A wheel with seams in treads is a most dangerous defect. It is also one of the most uncertain; that is, the inspector is often unable to decide as to the extent of the defect. It is found in new, as well as old wheels, but more commonly in wheels that have run from one to three years. It may show on the surface to a very small extent, yet under the chill it may be of very great extent, and for this reason it is difficult for the inspector to pass judgment. Seams in tread are most dangerous when located in or near the throat of the flange. In inspection for this defect, the inspector should watch all wheels that show any considerable extent of flange wear and where it is seen that the chill in the throat of the flange is beginning to show fine cracks, he may be sure he has found a dangerous wheel which should be removed.

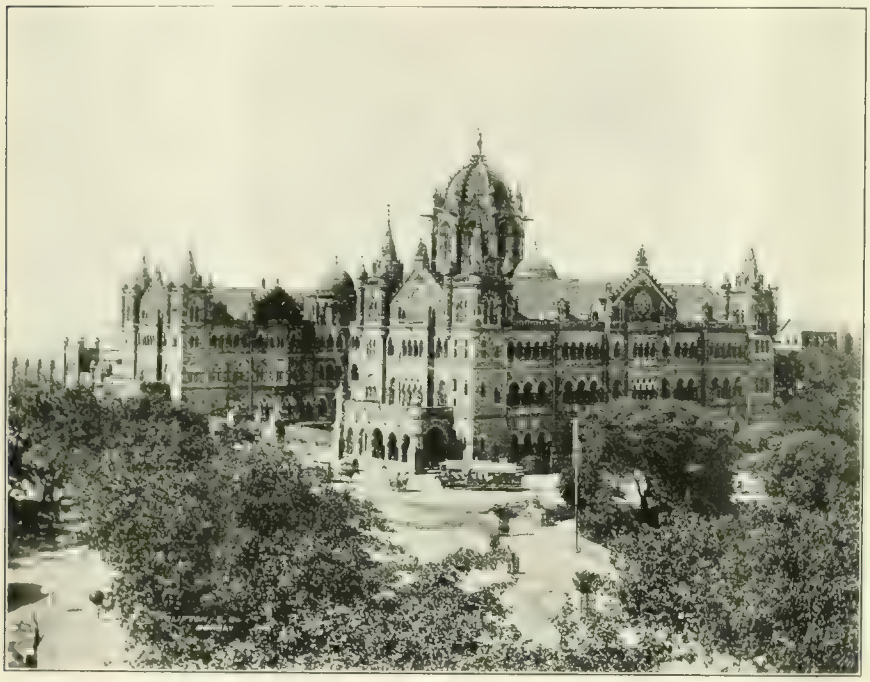
There are a great many chill worn wheels running that are beyond the safe limit. Wheels are often worn through chill, yet not worn flat, hollow, nor flange worn, at the same time they are worn entirely through the chill all the way around and are very easily broken. There are more or less seams in all cast iron wheels and although they may not be developed so as to be detected by inspection, where the wheel is worn through chill, they render it more liable to break. After a wheel has worn through the chill, it is no more than common gray cast iron and is absolutely unsafe for a car wheel. Wheels are often worn through chill in places for only a few inches, due to soft places in chill, or wheel having been slid. Such flats or worn places cause the wheel to pound and the tread is cracked thereby, thus making a very dangerous wheel. Wheels are often found worn hollow and not worn entirely through chill, and such wheels are dangerous on account of being liable to cause the flange or rim to break.

Worn wheel flanges should have careful attention. When flanges of wheels become worn sharp they are liable to cause a car to leave the track. Sharp flanges find defects of the track that are safely passed by good flanges. The trouble caused by sharp flanges is greater in train yards, where track curvature is usually very short. They are also dangerous on account of the liability of "splitting switches. All flanges do not wear evenly; flange on one side of wheel may be all right, while on the other side it may be worn to the condemning limit. Such conditions are caused by one of three things: First, the axle is liable to be slightly bent and cause the flange to wear on one side more than on the other, or, second, the wheel may be slightly warped, or third, the wheel may not have been bored true in fitting. As only a portion of a wheel flange can be seen to advantage while cars are still, the manner in which the tread is wearing should be closely observed. If it is noticed the wear on tread is near the rim and diagonal across tread toward flange, it will be found that wear on the unseen portion of flange is great and close inspection should be made. If axle is bent, causing this uneven wear, it will be found that both wheels are wearing in the same manner, but if only one wheel is wearing in this manner, it is most likely caused by wheel being warped or not bored true. Another way of detecting this defect is by watching cars as trains are pulling into yards or while they are being shifted in yards.

When wheels are found with flange vertically worn or sharp, but not condemning limit, it should be closely observed whether or not the wheel is chill worn in throat of flange, also whether or not seams have begun to develop, if either defect appear the wheel should be promptly removed.

There are a great many wheels loose on axle and they are often very difficult to detect. There is more or less danger in all loose wheels, but more especially when there is no shoulder to prevent wheels from working to the center of axle when they become loose. Where there is a good shoulder and not cut too far back on axle, there is not so much danger, for while the wheels work outward to a certain extent, as far as journal boxes will admit they usually work into place when going around a curve, without causing car to leave the track. Loose wheels are known to inspectors as "dry" and "wet" loose. "Wet" loose wheels are not so difficult to detect as the "dry" loose are, for the oil is an indication of loose wheels, although the wheel may not be loose in all cases where oil is found on inside of wheel. Such a case will, however, bear close inspection. Where oil is on inside of wheel, there is generally a collection of dust, and if it is cracked or broken the wheel is very likely loose. By closely observing this collection, it can be easily determined whether or not wheel has been turning on axle.

One of the greatest difficulties in the inspection for loose wheels, is the practice of many wheel fitters in counter-boring wheels, in order that axle will enter the bore of wheel without difficulty. This practice should be discountenanced as far as possible, for when counter-bored the wheel does not touch the axle where



VICTORIA TERMINUS, BOMBAY, G. I. P. RY., INDIA

visible, and thus destroys all indications of a loose wheel. The same difficulty is experienced with wheels where the "pan-cake" core, as it is called, is used. This core leaves the inside of wheels exactly like one that has been counterbored, so far as destroying the indications of loose wheels is concerned.

Chipped rims of wheels are usually caused by one of two things; hollow rim or tread worn hollow. This is one of the easiest defects to find as it is the outside of wheel and is at once manifest. This defect renders a wheel unsafe when it extends beyond the limit as laid down in M. C. B. rules.

Shelled out spots in wheels as a defect is becoming more frequent, on account of modern high break power, and when once started, the wheel soon reaches the point beyond safety. When a wheel starts to shell out, the constant pounding soon increases the size of the spot.

Where shelled out places are near the flange of wheel, the wheel at once becomes a dangerous one and should be removed. This defect should be watched very closely, especially on wheels in passenger trains, as the size of the sore spot increases much more rapidly on wheels in passenger service than in freight, on account of the faster speed and greater number of applications of the brake being made. A very small shelled out place in a passenger wheel will develop into a large one, in making only a few hundred miles.

In the inspection of wheels for slid flats, the inspector should not fail to closely watch trains as they are pulling into yards and the cars while being switched. There is rarely ever any indications of a slid flat on a wheel, except where it will be noticed the wheels are slightly spotted from sliding, and this it not a sure indication of a slid flat. In a great many cases a wheel will have quite a number of small flats, but none sufficiently large to condemn. If the inspectors do not get a chance to watch a train as it is pulling into the yard, the chances are slid flat wheels will be over looked, as in a great many cases the flat places stand on rail or behind brake shoes, and unless heard pounding while rolling into yards, they are not likely to be seen.

W. A. MITCHELL.

Nashville, Tenn.

Effect of Lengthening the Reach Rod.

I have a question I would like to have answered. I am a machinist on a railroad at Houston.

We have a class of 8-wheel passenger engines here which have been having trouble in making time. The engineers said they just would not make it, and came in late.

The M.M. came in the shop one day and gave orders to the foreman to have the reach rod of one of them lengthened ½ inch; understand the rod was the exact length it should have been. The motion was not changed except that the reach rod was lengthened. The engineer came in next trip on time and said the engine would outrun itself and every one should be worked on and changed.

Can you give any reason why the reach rod should make the difference, especially if it was right to start with?

MACHINIST.

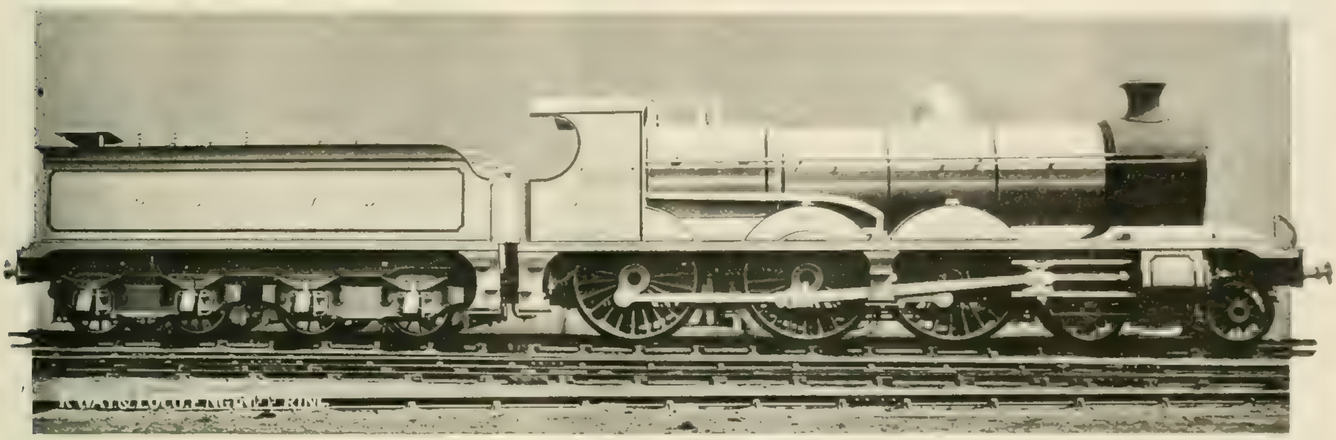
Lengthening the reach rod had the same effect as advancing the reverse lever a little. The engine would work stronger because the point of cut off was delayed.—Ed.

A contract has been awarded by the Baltimore and Ohio Railroad Company for additional passenger equipment, involving an expenditure of about $600,000. With this new rolling stock the company will be equipped to handle the World's Fair business to and from St. Louis next year. The order covers forty passenger cars and forty baggage and postal cars. Deliveries will begin in December, and be finished by April 1, 1904.

European Notes.

NEW ATLANTIC TYPE EXPRESS LOCOMOTIVE, NORTH EASTERN RAILWAY.

Following the practice of other locomotive engineers in adopting locomotives of the "Atlantic" type for heavy passenger traffic Mr. Wilson Worsdell has recently constructed at the North Eastern Railway Gateshead Works several, claimed to be the most powerful and largest in England. The accompanying diagram shows clearly the huge proportions of these locomotives which are built to the limit of the loading gauge and have 82 in. drivers and 20x28 in. cylinders. The boiler barrel has a length of 190.5 ins. The external diameter being 66 ins. and the height of center line from rail 107 ins. The fire box is long for British practice, i. e., 108 ins., and provides a grate area of 27 sq. ft.; the working pressure is 200 lbs. per sq. in. A large heating surface is obtained from the tubes, i. e., 2,275.8 sq. ft. which being augmented by 180 sq. ft. from the fire box brings the total up to 2,455.8 sq. ft. The engine weighs, in working order, 161,280 lbs., of which 87,360 lbs. are on the coupled drivers. The tender is of the standard pattern, carries 11,200 lbs. of coal and 4,125 gallons of water, and weighs, in working order, 97,440 lbs. These locomotives are being built for working the East Coast Scotch traffic and their performances will, no doubt, be watched with interest, especially when comparison is drawn with the working of the six coupled bogie locomotives of the 2001 and 2111 classes.



GLASGOW AND SOUTH WESTERN 4-6-0

NEW SCOTCH LOCOMOTIVES.

In the July issue of RAILWAY AND LOCOMOTIVE ENGINEERING one of the new Caledonian fliers was illustrated and described and in the present number is shown the new six-coupled bogie passenger locomotives for the Glasgow & South Western Railway. These engines have been built for working the Scotch

traffic in connection with the Midland Railway from London and most of the provincial towns, and previous to their introduction the trains have been worked by two ordinary bogie locomotives having 81 in. coupled drivers and 18½x26 in. cylinders. The new type have six coupled wheels 78 in. diameter, outside cylinders 20x26 in. balanced valves placed on top worked by a rocking shaft, a large boiler and a Belpaire fire box. The heating surface obtained is 1,852 sq. ft. and the grate area is 24.5 sq. ft. The engine weighs 150,080 lbs. in working order and with the tender, which is of weight. A new design of cab with side windows has also been provided. The chief dimensions are: Cylinders, 19x26 ins.; coupled drivers, 90 ins., placed with their centres 114 ins. apart; total heating surface, 1,577 sq. ft.; grate area, 22.5 sq. ft.; total weight, including tender, in working order, 206,080 lbs. The tender has a capacity for 3,525 gallons of water and 15,680 lbs. of coal. The increased weight of both the East Coast trains and also the Midland, Edinboro' and North trains necessitated more powerful engines, consequently Mr. Holmes designed the 317 class.

INTERLOCKING PLANT, NEWCASTLE CENTRAL STATION.

a new design running on four-wheeled bogies and carrying 4,100 gallons of water, the total weight is 262,080 lbs. Ten of these fine locomotives have been delivered by the North British Locomotive Company from their Atlas works, and are numbered 381-390, inclusive. Several novel features have been introduced and the steam reversing gear and steam sanding apparatus have been fitted.

The North British Railway Company have built several of their new passenger locomotives at the Cowlairs works, and they are an enlargement of their previous type, "729" class, the most important augmentations being in the size of cylinders, boiler and fire box, and total

NEW MIXED TRAFFIC LOCOMOTIVE, LONDON AND SOUTH WESTERN RAILWAY.

For working the new accelerated express trains from London to the west of England, Mr. Dugald Drummond has built at the Nine Elms Works a new class of mixed traffic locomotive having 72 in. coupled drivers, a leading bogie and a large boiler. As will be seen by the accompanying illustration the general features of the designer's standard practice have been adhered to, including the cross water tubes in the fire box. The latest pattern of eight-wheeled tender running on bogies has been built with the engine. One feature in those locomotives and which is the subject of a patent by Mr. Drummond, is the balanced crank axle, the cranks being built up and heavy projections forged with and directly opposite the webs. By this means the strains on the crank axle are, it is claimed, better counteracted than when the balance weights are placed in the wheels.

The distance from London (Waterloo) to Exeter is 171 miles, and with one stop for locomotive purposes at Salisbury the trains are timed to cover the distance in 3¼ hours.

A long distance record run on the L. & N. W. Ry. was made on June 19, with a special train conveying delegates of the International Telegraph Conference from London to Glasgow. The journey from Euston to Carlisle was accomplished without stopping, the distance being 299 miles. The train was composed of nine six-wheeled bogie dining saloons and two four-wheeled bogie brake vans, representing a weight of about 420 tons, and was drawn by two of the latest four-cylinder compound passenger locomotives. The time taken over this portion of the journey was three minutes under six hours. The train continued its journey over the Caledonian Railway to Glasgow, and on June 22 returned from Edinboro', the distance from Carlisle to Euston being again

accomplished, without a stop, in six hours.

CALEDONIAN WAGON STOCK.

The Caledonian Railway Company is adding largely to its stock of bogie wagons, and the illustration shows one of several recently supplied by the Leeds Forge Company, having a capacity of 30 tons. In comparison an old existing four-wheeled mineral wagon is shown of which the company possess a large number. The dummy buffer so prevalent on British wagon rolling stock has at last been condemned, and its entire withdrwal is to be effected by January 1, 1910.

LONDON AND SOUTH WESTERN 4-4-0.

PRUSSIAN TANK ENGINE.

The Prussian State Railways have recently received from Messrs. Henschel & Sohn, of Cassel, a heavy multi-coupled tank locomotive built on the Hagans articulated system for working the difficult portion of their road on the Stettin-Jasenitz section, which has many sharp curves and steep gradients. The cylinders are 20½x24¾ ins., driving wheels 3 ft. 11¼ ins., total heating surface 1,488.03 sq. ft., total weight, in working order, 7½ tons.

The Story of a Mechanical Flagman.

Not long ago, our old friend, Mr. Eli Guilderfluke, was appointed general master mechanic of the Great Gas & Wool gathering Railway, with headquarters at Flapdoodle, As. He was thoroughly pleased with the appointment, because he had been "rusting," as he expressed it, for a long time. His friends had urged him to take the appointment and had said confidentially to him, "Guilderfluke, old man, it's not only your ability to run the whole road which counts for so much, as it is your marvelous powers for revolutionizing everything in sight, which is going to score—you can leave them all at the post easily."

A few days after Eli had "taken hold" and had got "things humming," a young man in the motive power department of the G. G. & W. Ry. invented a mechanical flagman. This same sort of thing has been invented before now, and has proved to be a perfectly feasible project as far as mechanical construction and operation are concerned. The young man, however, invented it all over again, and devised a machine which would run back swiftly over the road, carrying a red flag by day and a red lamp by night. It was to be operated by compressed air stored in a reservoir which it carried, and the supply of air could be drawn from the brake line of a stalled train by simply coupling the air hose at the end of the train line with a similar hose attached to the reservoir. It is obvious that the stalled train could not possibly start while this charging-up process was in progress, because the brakes would be hard on, so any attempt on the part of the train to play the "flagman" false would be "nipped in the bud." The machine, not being human, when started out, would not be consumed with a feverish desire to return to its train, so it was presumed that it would go back far enough to warn a following train.

PRUSSIAN ARTICULATED TANK ENGINE

The young man made a model and it worked fairly well, and then he asked Mr. Guilderfluke to look at it and give his opinion as to its merits. Eli took a look at it very carefully with his practised and critical eye, and said, "it's all right, but it does not go far enough." The young man said that it would go back several miles. Then Eli explained slowly and ponderously that what he had intended to convey was that the invention was crude, that it needed improving, that the whole scope of the thing was limited, that the young man had not "overcome obstacles" which were certain to arise—had not "dealt with known conditions," and in fact had only seen the idea through the glimmering and misty moonlight of inexperience, and had failed to dash into the scorching sunlight of day and garner the ripe and rich harvest with a bold and skilful hand. The young man felt awfully sorry that he had invented anything, but asked as a favor if the great inventor would design to indicate briefly how even a few of its many shortcomings might be, in any way, rectified.

Eli told him offhand that the machine ought to have a small mail-pouch attachment in which a written statement, signed by conductor and engineer, might be placed. Said statement to contain a full description of the hot box or the burst hose, or whatever it was that had stalled them, for the information of the following crew, and Eli suggested a seat on the machine, in case they might at the last moment want to send a man back a little way to oil it and see that everything was working all right. The young man thanked Eli profusely, but the great man said he was always glad to help bright young men along, and that he would make a sketch of the invention at home that evening, giving the whole thing wider scope and enlarged powers.

Next day, when the two "got together," Eli explained his sketch to the young man. The machine had certainly

been "modified," but the young man was able to recognize some of the salient features of his invention. There were the wheels to be sure, but they were larger and better—more adapted to the work they had to perform, you know. There was the compressed air reservoir—re-designed to stand "modern pressures," you see. There were the lamp holder and flag socket—yes, but more firmly secured to a new and much stronger frame, you understand. There was the seat for the attendant, suggested last evening—but of improved design, automatically collapsible, after three minutes' use, to prevent the attendant riding back too far, and subsequently claiming mileage.

Guilderfluke explained further that he would equip this machine with suitable apparatus in the shape of buffers and springs, a three-way cock and a wide-open-let-go attachment, so that if the engineer of an approaching train failed to observe the mechanical flagman and should strike it and knock it off the track, then the machine would automatically protest against that sort of unfriendly treatment by every resource known to the science of mechanics.

An air whistle had been provided in the sketch, and this whistle would sound continuously the moment the machine was lifted off the track by the pilot of the on-rushing and impudent engine. The sky-ward motion of the "flagman" would also appropriately set off a battery of rockets and explode a string of torpedoes, a huge alarm-clock bell, with double hammer, would "burr" unceasingly the moment the forward wheel of the "flagman" was raised even half an inch off the rail, while the collapsible seat would flap like anything. He showed how the whole mechanism, by a beautiful and harmoniously worked out plan, would, under the circumstances, devote its energies to the work of registering an emphatic "kick," which few would have the hardihood to resist.

If, however, this "warning" should be disregarded, and the whole thing thrown over the fence, Guilderfluke said he had arranged that the good work should still go on. A pair of powerful electric "magneticons," as he called them, operated by a storage battery placed below the frame, would infallibly bring it back to the track, at the same time reversing its motion, so that it might now pursue the train which had despitefully used it. As soon as it had overtaken the fugitive train—as it certainly must, by reason of its great speed in the back-up direction, due to the electric magneticons working in unison with what was left of the compressed air, then the real serious work of the "flagman" would begin. A trigger of peculiar shape on the back of the "flagman" would engage in mortal combat with the rear angle-valve handle on the train and eventually turn it, thus opening the train line, and so bring the train to a stop. A train so "warned" would likely be glad to surrender rather than keep up the unequal struggle.

At this stage of the proceedings Eli sent for his master mechanic and general foreman and asked them what they thought of it. The M. M. didn't say much—he just thought, but Rabid Noyes, the foreman, who is a most unpleasant fellow, wanted to let the machine have a big grab hook arranged to rip off the air hose from the pilot of the "approaching" engine if she tossed the "flagman," and so stall her right there, and he also said, sarcastically, that he would provide a recording phonograph to take in what the men on the engine said when they found out what they were up against. Noyes thought that would do away with the "magneticons," and the whole of the back-up paraphernalia and so save expense, but Guilderfluke showed at once how crude that idea was.

"By removing the storage battery, the electric magneticons and the combat-trigger," he said, " you would greatly reduce the weight of the machine, and so bring her tractive effort away out of line with her adhesive weight, so that she would be 'slippery,' non-efficient and practically inoperative, don't you know; and further, the phonograph would only record the mingled sound of the whistle, the rockets, the detonators, the alarm-clock bell, and the flapping of the seat, and such a record would be quite valueless." Rabid Noyes retired feeling miserable after being shown up, as he deserved to.

Eli Guilderfluke, kind old fellow, is preparing patent claims for the young man, and is not going to take any undue credit to himself in the matter—he doesn't need to. He made his reputation years ago when he got out the perfection locomotive, which was, as all remember, published in LOCOMOTIVE ENGINEERING in December, 1897.

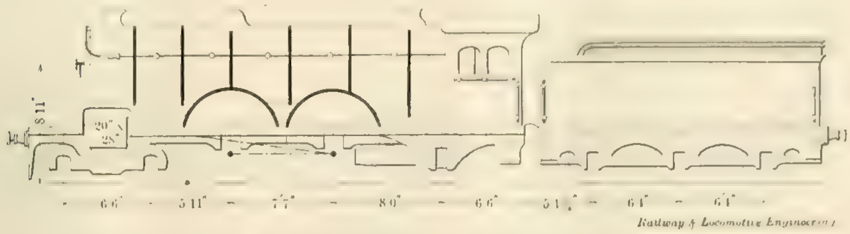
SPECIAL TRAIN FOR DELEGATES, INTERNATIONAL TELEGRAPH CONFERENCE, L. & N. W. RY.

Be as rich as you honestly can. It's your duty. If not for yourself, for others.—*Little Dorrit.*

New S. O. Shops at Los Angeles.

In regard to the new shops here lack of material is still the drawback, although things are coming our way slowly, but surely. There have been a few changes made in the details for machine shop, and Mr. Campbell says he will endeavor to send you prints as soon as they are ready. Since writing you last, it has been decided to put in quite a number of additional machine tools in machine shop, necessitating the building of more concrete foundations. The location of same has not as yet been decided. Quite a number of tools have been set on their foundations and are now being cleaned and set up. The floor in machine shop is laid except for a space around the 42 and 44 in. engine lathes and 72 in. planer, where jib cranes with air hoists, capable of lifting from 4 to 6 tons, are to be put in. Concrete foundations for tools in blacksmith and boiler shop are now in, and boiler shop is to have a 30-ton traveling crane, the material for which has not yet arrived, nor the material for the 10-ton crane over driving wheel machines in machine shop. The 70 ft. transfer table is on the ground, but has not been assembled. The turntable in round house is to be lengthened out to 70 ft. instead of 65 ft., as I had in my last letter. Roof is now on the coach repair shop, and two 65,000 gallons steel water tanks have been erected east of round house, in which is now being laid creosoted blocks run with tar for a floor. Besides the new shops here, the company is building a new steel double track bridge over the river above Elysian Park, and also practically rebuilding the single track bridge at the shops with a double track one. This is all I can let you know about just now, but will keep you posted from time to time, and hope you will get this in time for the September issue.

O. H. Van Rensselaer.
A. M. E.



NORTH EASTERN 4-4-2 ENGINE.

Long and Short Valve Travel.

I am under the impression that you have said at different times that the rapid opening of the exhaust in locomotives with long valve travel tears the fire more than exhaust steam escaping more gradually as happens when the valve travel is short. That can only be a hypothesis, but I know several locomotive engineers who believe it to be true. Now why is this not a good subject for investigation? There is going to be a great testing plant installed by the Pennsylvania Railroad Company at the St. Louis Exposition next year, and it seems to me that they would be working in the interests of all railroad companies if they would thoroughly test the valve of long and short valve travel.

M. E.
Pittsburgh, Pa.

An Injector Puzzle.

A man learning to run a locomotive ought to practice thinking out the solution of any disorders about the engine that are likely to happen and I send you a puzzle for firemen and young engineers to guess about. I enclose the solution on another sheet.

OLD 4-WHEEL MINERAL WAGON

An engineer came in and reported that his right hand injector would not work. All the explanation given was that it broke every time he tried to work it. A machinist, who is an expert on injector disorders, was sent to remedy the defect and make the injector work. He took the injector down, examined it, and found nothing the matter. By the teaching of past experience he then decided that the trouble was in the feed-pipes, so he examined the strainer and tender valve and found nothing there to obstruct the flow of water. Then he was forced to the conclusion that the check valve was stuck down, so the engine was cooled down and the check valve found in working condition. Then it looked to be a case out of the ordinary line of disorders. What was the matter?

Wooley West.
Chicago.

Keying Eccentrics Before Valves Were Set.

Forty years ago it was quite a common custom in some locomotive shops to key the eccentrics to the shaft before the wheels were put under the locomotive.

The position of the eccentric bears a fixed relation to the position of the crank pin, and it is much easier to slot the shaft before the wheels were under, than later. To what extent is it now practiced? Some locomotives have eccentrics forged on the shaft. To turn them up false centers were made in the shaft. or in heads secured to the shaft.

[illegible]

The edition of Blackall's Air Brake Catechism, which we have been selling at $1.50 per copy, has been exhausted, and we are therefore not in a position to fill the many orders which have come in for it. A new, revised and enlarged edition of this valuable book will be out toward the end of September. It will contain 310 pages, 100 illustrations and 11 folding plates, including three printed in colors. This is the eighteenth edition. and the price will be $2.00 per copy

CALEDONIAN NEW 30-TON BOGIE WAGON

It is in the finishing touches alone that great experience and long study tell.—*Mr. Pecksniff.*

Railway and Locomotive Engineering

A Practical Journal of Railway Motive Power and Rolling Stock.

Published monthly by

ANGUS SINCLAIR CO.,

174 Broadway, New York.

Telephone, 984 Cortlandt.
Cable Address, "Loceng," N. Y.
Glasgow, "Locauto."

Business Department:
ANGUS SINCLAIR, President.
FRED M. NELLIS, Vice President.
JAMES R. PATERSON, Secretary.

Editorial Department:
ANGUS SINCLAIR, Editor.
F. M. NELLIS,
GEO. S. HODGINS, } **Associate Editors.**
JOS. A. BAKER,

Advertising Department:
Eastern Representative, S. I. CARPENTER, 170 Summer St., Boston, Mass.
Western Representative—J. A. BAKER, 1204 Monadnock Block, Chicago, Ill.

British Representative:
THE LOCOMOTIVE PUBLISHING CO., Ltd. 102a Charing Cross Rd., W. C., London.

Glasgow Representative:
A. F. SINCLAIR, 7 Walmer Terrace, Ibrox, Glasgow.

SUBSCRIPTION PRICE.

$2.00 per year, $1.00 for six months, postage paid to the United States, Canada and Mexico. For other parts of the world, $2.50, or ten shillings. Single copies, 20 cents. Remit by Express Money Order, Draft, Post Office Order or Registered Letter.

Mailing address can be changed as often as necessary—always give old and new address, and if you subscribed in a club, state who got it up.

Please give prompt notice when your paper fails to reach you properly.

Entered at Post Office, New York, as Second-class mail matter.

No Need to Investigate Locomotive Front Ends.

The committee of the American Railway Master Mechanics' Association, which has been investigating the subject of locomotive front ends, in connection with the *American Engineer and Railroad Journal*, has come to the end of its labors at present for want of funds. In a brief report submitted to last convention the committee intimated that at least $4,000 is necessary to go on with the first year's work. As there are no funds in the Association's treasury available for use in making tests the money, of course, will not be forthcoming.

We do not think that there is any pressing need for heavy expense being incurred to pursue this investigation, for the subject of locomotive draft appliances has received more attention from the Association than any other question, and very thorough tests have been made by various committees whose labors furnish all the information that can reasonably be looked for and much more than what has been made use of. Tests of draft appliances made on a stationary plant have positive limitations that make them little better than suggestions to guide people wrestling with road conditions; and it is doubtful if experiments made on the Purdue testing plant will add anything to the information elicited by the extraordinarily exhaustive tests made on the Milwaukee, Lake Shore & Western testing plant, designed by Mr. Robert Quayle, and conducted under his directions in 1894, and also the even more comprehensive tests made on the Chicago & Northwestern testing plant in 1896, conducted under Mr. Quayle's supervision and reported by a committee of which Mr. W. S. Morris was chairman. It would be hard to conceive any detail concerning the action of locomotive draft appliances that these committees failed to investigate, or of the influence of any combinations for producing draft and relieving back cylinder pressure that were not tested. Those who want more light on the subject of draft appliances are mostly people who have never found out what the reports reports referred to demonstrated.

At the second convention of the American Railway Master Mechanics' Association, held in Pittsburgh in 1869, a report on smoke stacks was presented by a committee of which Mr. Reuben Wells was chairman, and it discussed all details of what are now known as "draft appliances." Since that time there have been reports or discussions of draft appliances in some form at every convention held by the Association. It has been an easy resort to investigate smoke stacks, exhaust nozzles, grate openings, brick arches, or extension fronts when live subjects were lacking; and the introduction of any one of these subjects seldom failed to excite discussion in which nearly every member was ready to join. There has been more interchange of experience elicited by these subjects than by all others combined, and they have always been popular because many people were given the opportunity to talk on a subject concerning which they had decided opinions.

We have frequently heard the complaint made that many members of the railway mechanical associations discuss reports at conventions and seemingly indorse the recommendations of committees, then go home and pay no more attention to what has been agreed upon as better practice than that which they are following. Men listen to committees' reports as they listen to sermons. They have a vague idea that they would like to follow the precepts inculcated, but it is found easier to forget than it is to practice what may entail some self-denial or exertion.

This line of reflection readily intrudes itself in connection with the small influence exerted on locomotive practice by the two splendid reports on exhaust pipes and steam passages. The conclusions arrived at by the committee read:

"The work on the Chicago & Northwestern testing plant relates principally to the proper design of an exhaust pipe and nozzles for maximum efficiency, and the results obtained are believed to confirm the following conclusions:

"First.—The exhaust pipe should be as short as possible with a proper arrangement of diaphragm and netting, providing this does not make it less than 19 inches high, which is the lowest limit tested.

"Second.—The bridge in this pipe should not be less than 13 inches high.

"Third.—The area of each of the openings of the pipe at the most contracted part should not be less than the area of the nozzle.

"Fourth.—When it is necessary to reduce the area of the exhaust opening, it should be done at the nozzle and not at the choke.

"Fifth.—The nozzle should be raised when necessary by lengthening the portion of the pipe above the top of the bridge, rather than that below.

"Sixth.—The form of exhaust tip shown as X in these tests gives better results than either forms Y or Z. (The tip X has a cylindrical opening; Y is tapered toward the opening, and Z has an inside flange at the opening.)

"Seventh.—The distance from the choke of the stack to the nozzle for 14-inch choke, stack 52 inches long should not exceed 50 inches, nor be less than 40 inches for maximum efficiency.

"Eighth.—The distance from the top of the smoke arch to the nozzle with 14-inch straight stack 52 inches long, should not be greater than 38 inches, nor less than 23 inches.

"Ninth.—The distance from the top of the smoke arch to the exhaust nozzle with a 16-inch straight stack 52 inches long, should not be greater than 38 inches nor less than 28 inches.

"Tenth.—The efficiency of the steam jet is reduced by spreading it by means of cross bars in the nozzle.

"Eleventh.—Cross bars not wider than ⅜ inch placed in the nozzle or above it nearer than 1 inch increase the back pressure; wider cross bars increase the back pressure when farther removed in proportion to their width.

"Twelfth.—A petticoat pipe with the single nozzle, when properly arranged, increases the efficiency of the jet.

"Thirteenth.—Double nozzles, with 14-inch choke stack and 16-inch straight stack, 52 inches long, are not as efficient as single nozzles, the difference being very slight.

"Fourteenth.—Double nozzles should be located with reference to the stack the same as single nozzles.

"Fifteenth.—The maximum height of stack, measured from the exhaust nozzle, if the diameter of the choke is properly chosen, need not exceed five times this diameter. For cylindrical stacks the ratio of diameter to height is the same.

"Sixteenth.—The vacuum decreases as the stack is shortened, and more rapidly

with the cylindrical than with the conical stacks.

"Seventeenth.—The decrease in vacuum due to shortening the stack within certain limits can be nearly overcome by lowering the nozzles. The amount which the nozzle should be lowered with cylindrical stacks is almost equal to the amount the stack is shortened."

These conclusions embrace the discoveries made by the most exhaustive series of shop tests that had ever been conducted on locomotives, and they answer questions that locomotive men are constantly asking without knowing where to look for the answers. The committee recommended proportions for a front end which they had found to produce the best results in the tests made and it ought to have been adopted as a standard of the Association; but it was not, and the members have never reaped the benefits of the valuable work done. Instead of appointing new committees to make other investigations of locomotive front ends, one ought to be appointed to let the members know what has already been found out. It is doubtful if ten per cent. of the members of the Railway Master Mechanics' Association remember that exhaustive tests of front ends were carried out in 1896, and we feel sure that less than one per cent. of the locomotives on this continent have been equipped with the front end recommended.

The "Normal Danger" and the "Normal Clear" Automatic Block Signal Systems.

There are in general two systems of automatic block signals used in this country. One is called the "Normal Danger" system and the other is called the "Normal Clear" system. These expressions are intended to indicate the position of every automatic block signal on the road at the time when they are not influenced by the presence of a train in the vicinity.

With the first mentioned, or normal danger system, every block signal on the line would stand at the danger position if all trains were off the main line. When a train is running on the main line, the signal immediately in front of it would remain at danger until the train reached some point a definite distance from the signal, say 2,000 feet, then if the apparatus was in working order, the signal would "clear" and permit the train to proceed, and after it had passed, the signal would again assume the danger position, and a following train could not "clear" this signal until the first train had passed out of the block ahead.

When the home and distant signals are on the same post, the following takes place, and to make a beginning somewhere in a continuous series of actions, we may put it this way: As train No. 1 approaches signal A, both the home and distant signals, we will assume, are standing "clear," so that the train may go on and demonstrate the working of the system. The entrance of the train into block A produces three effects. First, it causes the home signal at C to "clear" if no train is in that block. The "clearing" of home at C then acts upon the distant signal at B and causes it to "clear" also, and it sets the signals behind it at danger. The home signal at B, as can now be seen, had been "cleared" when the train was in the block preceding A. When the train gets to B both these signals will be found at "clear," which indicates that block B is free of trains and also that block C is clear.

With this system the home signal indicates, when it "clears," that the block it guards is clear, and the distant indicates that the block beyond is also clear. By this means the train "feeling its way" along, as it were, is informed whether either of the two blocks ahead are occupied. As the train passes into each block both signals behind it at once go to "danger" and the home at B cannot be made to "clear" again until the train is in block C, and the distant at B cannot be "cleared" until the train has entered block D. The normal danger system meets a question asked by an oncoming train, with a definite reply. The signals stand at danger until "asked" by the train through the electric connection, if it may be permitted to proceed. The answer is definite in each case, and concerns two blocks ahead.

The normal clear system, as its name implies, has all its signals at "clear" when there is nothing on the road. The approach of train No. 1 to block A does not alter the signals which are standing at "clear" and which permit the train to rush on. As soon as the train enters block A, both signals fly to "danger" and protect the train from the rear. The train having passed, the home signal on post A will only "clear" when the train has passed out of block A and the distant signal on the same post remains at "caution" until the train is out of block B and is in block C. Thus these signals reveal to following train No. 2 the condition of the road for two blocks ahead and when the semaphores are in the "clear" position they guarantee the line for that distance to an oncoming train.

If the normal clear signals should get out of order they at once assume the danger position, and so though they may cause delay, they act on the side of safety. With the normal danger system a signal out of order would be indicated by the inability of an on-coming train to "clear" it when the block ahead was actually unobstructed. This also might occasion delay, but the claims of safety would have been recognized.

Both these systems, when in good working order, are equally truthful in the indications they give concerning the presence or absence of a train in the blocks they stand for. In fact the two systems may be likened to a man passing through a long suite of rooms connected by doors. With the normal danger system all the doors would be shut but each would fly open as he approached it, if he was entitled to entrance to the room ahead, and would close as he passed in. The normal clear system would have all the doors open, but would close any one against him, in due time, if the room he desired to enter was occupied at the time, and a door would close behind him every time and stay closed until he was in the room ahead.

The normal danger, says to an oncoming train, "Ask me at every block and I will answer; I will tell you when and how you may proceed." The normal clear, says, "Go steadily on, with an eye for my warning, but stop when I bid you stay."

Loading Locomotives to Their Full Capacity.

The Chicago, Rock Island and Pacific operating department seem to be determined that their freight locomotives shall pull all the cars within their capacity. They have introduced a system of daily reports which shows just what percentage of the total power of the locomotive is being used each trip. The reports are based on a table compiled from the dynamometer car, which determines the actual tonnage which an engine can handle on certain grades.

The table was compiled by means of test trains. The dynamometer car is coupled direct to the engine and the remainder of the train to it. The drawbar is attached to a graduated spring scale. The engine is loaded with the full tonnage, and at every grade a record kept of it which is used as the basis of the table. Each different class of engine is tested, so that the table is complete. The tonnage capacity of the engines varies at different grades, so that a separate list is kept of the capacity between various stations.

The conductors of all trains now have to furnish the chief dispatchers a list of the tonnage of their train at the various points on the system. From this the chief dispatcher figures the exact percentage the engine is doing of the work it is capable of doing. Usually this averages about 90 per cent., and this is considered good. If the percentage falls below 90 per cent. then the engineer, conductor or dispatcher is called on the carpet and asked to explain, and usually receives instructions not to let it occur again.

The reports are made by the conductors at the end of each trip, and the dispatchers forward a daily report to the main offices. In some instances the percentage may run over the 100 per

cent. mark, as on through trains the load is based upon the tonnage the engine is able to haul on the heaviest grade on the division.

By means of these reports the company is able to compute the exact cost of handling freight and to keep close tab on useless expense in running engines over the road without half a load.

There are two well known systems of train operating, the merits of which have been exhaustively discussed in these columns. One system is to load an engine with a train that she can pull comfortably and make good running time, say an average of eighteen miles an hour, including stops. The other plan and that adopted by the Rock Island people is to load the engine with all the cars she can haul over grades making an average speed below ten miles an hour. Superficial inspection would lead people to believe that the heavily loaded engine is doing the work at the smallest possible expense, but she is not doing anything of the kind. The moderately loaded engine is doing the better work for the company, makes operating of trains more convenient and is much more comfortable to trainmen than the slow and heavy movement. It also serves to prevent the loss of business due to shortage of cars.

The Fellow Servant Iniquity.

We have repeatedly commented upon the working of the Common Law of England as applied in this country which prevents railroad companies and other employers from being held responsible for damages for accidents due to "the negligence of fellow servants." That law is the worst relic of barbarism that we know of being applied to modern industrial conditions; for it came into force by degrees when every servant was known intimately by his fellow servants, who could refuse to work with any one who was a reckless, careless or dangerous character. Modern conditions of employment keep hundreds of persons classed by law as fellow servants who have no acquaintance whatever with the character and habits of each other. Equity and justice demand that laws should be enacted to take the place of the Medieval Common Law and that progressive action has been taken in many States, but the State of New York still adheres to the barbaric law, although many attempts have been made to pass an equitable law to take its place. Of course, the old law is kept in force because large corporations prefer to pay as little compensation as possible for injuries or death inflicted upon employees by the reckless or careless acts of fellow employees.

So far as the railroad side of this matter is concerned, there is a curious condition of affairs in New York State. The laws enacted in most States to abolish the common law power to deal with accidents to fellow servants, have been promoted by railroad labor organizations which have taken a prominent part in working for a change. In New York State the legislative board of the Brotherhood of Locomotive Engineers have done all in their power to prevent any change from being made. Why they should do this we can only conjecture. One thing is certain—the ordinary members of the Brotherhood of Locomotive Engineers ought to institute a very searching inquiry into the cause of their interests being so grossly misrepresented by the board appointed to promote their interests.

An Employers' Liability Act was passed by the Legislature of New York last winter and it originally contained the clause, "By reason of the negligence of any person in the service of the employer, who has charge or control of any signal, switch, locomotive engine or train upon a railroad" which if passed would have canceled the common law iniquity; but Governor Odell raised strenuous objections to the clause, the Legislative Board of the Brotherhood of Locomotive Engineers appeared against it, and the clause was left out. Now a great many railroad men are naturally asking why did the representatives of their class take this stand?

New Self Hardening Tool Steels and Old Machines.

In machine operations in railroad or other shops, they are three factors which go to make up what may be called the efficiency of the machine. These are the cutting speed, or the speed at which metal is cut off. The feed, which is the amount of advance which the cutting tool makes at each stroke of the machine, or at each revolution of the work. The cut, which consists of the depth of metal removed. All these when combined to their highest point give maximum output.

Not long ago several new self-hardening tool steels were put upon the market, which were capable of doing much more work and lasting much longer than the tool steels with which shop men were then familiar. It was at once apparent that high cutting speeds, increased feeds and greater depths of cut were in order. The immediate result was the speeding up of main line shafting. A large manufacturing establishment which in order to get maximum efficiency out of a special grade of tool steel increased the speed of their line shaft from 90 to 250 revolutions, with the phenomenal result that a gain of 340 per cent. in the amount of metal removed per hour was thereby effected.

The heavy strains thus put upon the machines themselves have lead to practically a re-designing of many standard tools by tool builders. Beds have been strengthened, gears have been widened and a general increase of stability and staying power, if one may be allowed to say so, has been added in all tools intended for really heavy work. The advent of the new tool steel has in many cases put comparatively new tools out of business by reason of their not being able to stand up to the work the new tool steel could do.

Transportation in New York.

Artemus Ward is reported to have said on one occasion, that whenever an emergency arose he just liked to see a man come along who could cave in the head of that emergency right there. That is about the feeling which rises in the mind of anyone who reads the admirable paper by Mr. W. W. Wheatly on "The Transportation Problem of Greater New York," a brief abstract of which appears in another column.

There is no one great cure-all for the overcrowding which takes place during rush hours, but there are two forms of the detention "emergency" which constantly arise, and these two heads should be speedily caved in if we are to have comfort, and the thanks of the community will be gratefully given to the man who does it. The statistics given by the author of the paper should carry great weight as he was formerly Assistant General Superintendent of the Brooklyn City Railroad and knows whereof he speaks.

There are on surface lines, daily, numerous petty detentions to cars, which in the aggregate, lengthen out the time occupied on every trip. All sorts of street obstructions bar the way. Heavy trucks do not, as a rule, turn out from the tracks until the car has slowed down or stopped, and until the noisy and insistant gong has annoyed everybody within ear shot. The driver of the truck really gains nothing by his tardiness and the car with its load of passengers loses time, uselessly. There is no doubt that some reform is now in order which will minimize these petty detentions along the road. From about 5 to something after 6 P. M., the whole business of lower New York is to get home, and from the facts and figures brought out at the club meeting, the complete prohibition of heavy vehicle traffic along important street car routes during rush hours does not appear to be a harsh measure. The number of those who would suffer by its enforcement would be quite insignificant compared with the vast multitude who would be benefitted. Municipal authority is of course the only force competent to act in the premises.

In the case of elevated or steam suburban lines where track is not obstructed, the cause of detention along the line

must be dealt with by the companies themselves. One important reason for delay at stations is the fact that in handling great masses of people, railroad companies still continue to use cars with end doors, and some of the doors at the present day actually swing on hinges. In many cases the floor space of the car is wasted as far as seating accommodation is concerned. Crowds of people are compelled to fight their way on and off the cars, to the great inconvenience of themselves and the detention of the entire train.

Last month we called attention to the design of suburban cars proposed by the officers of the Illinois Central Railroad, by which 120 persons can be provided with seats, and by which there would be a side door for every 10 or 12 persons. The time required to fill and empty one car, or for that matter the whole train, would not be greater than that required for the movement of the occupants of one compartment, and that can be brought down to about 10 seconds. The average time at way stations would probably be even less than this, owing to the fact that it is likely only a few persons would get in or out of any given compartment.

Engines or electric motors with high tractive power and capable of giving very rapid acceleration are necessary and useful in their proper place, but the loss of time along the road, in city and suburban traffic has not as yet received that measure of attention which it deserves, and which the pressure of a growing population in all our large cities and towns is steadily forcing to the front. The Illinois Central has by its new designs of suburban cars, made a determined effort to cave in the head of one form of this delay "emergency," and what can be done in the West can be done elsewhere, and ought to be forthwith attempted.

Book Reviews.

The Art of Pattern Making. By I. McKim Chase, M.E. Publishers, John Wiley & Sons. 1903. Price, $2.50.

This book is a comprehensive treatise on the subject, in which numerous examples of all kinds of pattern work are given for green-sand, dry-sand and loam molding. Pattern work for marine engines and screw propellers is taken up, and useful information and rules are given for the practical use of pattern-makers and others. The book contains 254 pages and is illustrated with 215 figures. It is about 5x7½ inches in size, and has been written by a practical man who can do the kind of work he writes about.

The subject of the intersection of cylinders of different sizes and at various angles is elucidated and the appearance of the line forming the intersection is shown when "developed." The way to correctly draw this developed line is made clear by the use of a little paper pattern which the reader is instructed how to make. Following this subject comes the teeth of gear wheel patterns, and belt-pulleys and flywheels, with numerous worked-out examples for the proper proportioning of parts, etc. Altogether the book is useful and clear and, moreover, it is well printed and neatly bound.

Compound Corliss Engines. By Jas. Tribe, A.S.M.E. Published by the Author. First edition. 1903. Price, $2.50. For sale by Railway and Locomotive Engineering.

In the Preface the author thus describes his work: "In its present form this book is an elementary text-book on the generation and utilization of heat and the transformation of heat energy into mechanical energy by means of the multi-cylinder Corliss steam engine. Although the work is theoretical in treatment, it, nevertheless, aims to be thoroughly practical in its purpose, all of the examples being based upon actual up-to-date practice, and the data from engines which are actually built and running."

The subjects included in this work of 178 pages, are Steam, Water for Steam, Heat, Energy, Economy of Expansion, Theoretical Diagrams, Horsepower, Multiple Expansion, Steam Jackets, Single-Cylinder Engines, Double Expansion and Non-condensing Engines, Double Expansion Condensing Engine, Electric Generators, Double Expansion Pumping Engines, Triple Expansion Engines, Quadruple Expansion Engines, Receivers, Condensing Apparatus and Injection Water. There are also eighteen tables containing useful information on various subjects connected with steam engineering.

Roof Framing Made Easy. By Owen B. Maginnis. Publishers, The Industrial Publication Company. 1903. Price, $1.00.

This work, of over 150 pages, is now in its second edition and has been revised and enlarged. The language employed is that which would be used by a practical workman and the carpenter or builder who studies the methods therein described will gain a knowledge of the constructive value of every piece of timber which forms part of a framed roof. He will also understand how to lay out each piece and so save himself from the laborious method of "cut and try." All kinds of roofs are dealt with and many are illustrated. The book will be found useful to those who have this kind of work to do.

The Derry-Collard Company, of New York, have got out an ingenious mechanism which is not exactly a valve motion model because there are no rods or eccentrics connected with it. It may more correctly be described as a valve motion demonstrator because the motion of the valve with reference to the piston may be studied by its aid. It is made of heavy Russia iron and is 14x18 ins. and stands 21 ins. high. The valve is full size and the inches of piston travel are marked on the graduated disc. Turning the crank moves valve and shows the piston travel as in actual service. With this demonstrator different kinds of piston and slide valves may be studied as a number of cards representing the various kinds in ordinary use, go with the apparatus. One may obtain the effect of regular link motion with increasing lead when reverse lever is notched up, or the effect of decreasing lead may be produced, due to what is often called "crossed" eccentric rods, or the effect of constant lead may be had with this mechanism. It is sold for $30, delivered, and may be secured through this office.

The Pratt & Whitney Company have just issued one of their standard 6x9 booklets, dealing with their Bench Lathe, 10-inch Tool Makers' Lathe, 13-inch Engine Lathe and 14-inch Gibbed Carriage Engine Lathe. The book contains 67 pages and is fully illustrated with excellent half-tone plates. The first thirty-seven pages of the book are taken up with a description of the 7x32-inch Bench Lathe. This machine is described in detail and illustrations are given of more than thirty of the various attachments which may be furnished with the lathe, thus giving an adequate idea of the great diversity of work for which this machine is adapted. The 10-inch Tool Makers' Lathe is also fully described, and illustrations are given showing the application of the collets and split step chucks to the spindle. There are two views of the 14-inch Lathe, one showing the standard lathe, the other the lathe with pan bed. A number of important attachments for this lathe are also illustrated and described. These include the relieving attachment for relieving straight, taper and spiral taps and milling cutters, draw-back collets, step chucks and closers and expanding arbors. While these lathes perhaps are not applicable to rough shop use, anyone who cares for good machines or who has to do accurate work will appreciate them. This catalogue will be sent to anyone who is interested enough to write to the Pratt & Whitney Company, of Hartford, Conn.

"With a comparatively rough exterior there was no one whom I knew whose sympathy for an unfortunate person would be more easily aroused and whose interest in assisting one in trouble more ardent than that good old man," was said by a well known railroad man writing about Pulaski Leeds.

QUESTIONS ANSWERED.

(58) C. W. C., Leadville, Colo., writes:

I have had considerable trouble with the metallic piston rod packing, the piston rod rides the packing so hard it cuts the packing out in a few days. The machinist raised the cross head end of the piston, but that did not do much good, so I went to the round house and took off the cylinder head myself and found a solid piston head and the follower plate dragging on the bottom of the cylinder. I suggested turning the piston round, but the foreman said he never heard of such a thing. I have always understood it was the general practice with solid heads. If they are turned over, where are they turned, on the piston rod or is the piston rod turned in the cross head? A.—It is not general practice to turn pistons this way. If the piston was worn so much on the bottom as to require turning, it was about time that another one was substituted for it. With cross head and piston correctly in line, rod quite smooth and sufficient play in the vibrating cup of the packing, there should not be the excessive wear you speak of.

(59) W. C., Dunedin, New Zealand, writes:

In the twenty-first edition of Angus Sinclair's book on Locomotive Engine Running and Management, there is one question on page 386 which I would like to have explained. It is question No. 16, and reads: "Will steam come out of both cylinder cocks on the same side at the same time?" A.—The answer given in the book is, "Yes; if steam port is open." This must be taken in connection with question No. 15, which deals with the detection of a blow of steam past the cylinder packing. If the engine was standing, for example, so that it would take steam at the front end, it is obvious that the front steam port must be open and the front cylinder cock would then blow. If the cylinder packing was not tight, steam would leak past it into the back end of the cylinder and blow out of the back cylinder cock. Under these circumstances the blow out of the front cylinder cock would be the stronger of the two, but both would blow at the same time.

(60) F. J. C., Albuquerque, N. M., asks:

How much variation from determined standards the manufacturing companies will allow in the size of their injector cones, the delivery ends of the several sections, the tapers and the spaces between the delivery end and the receiving end of the next one? A.—The manufacturers will not permit the slightest variation from their standards. One of the manufacturers recently said, in a letter on a question like yours: "Injector nozzles are very delicate instruments of precision, in the interior diameters and concentricity, of which a variation of the one-hundredth part of a millimeter is sufficient to ruin its functions." Injectors may be made to give a high lift or a low lift, they may be made to work with warm or with very hot water, and for each of these four cases makers have experimentally determined the best adjustment. Any variation, then, from the best adjustment for a particular kind of service, they hold to be a step backward.

(61) R. C. asks:

Why does air heat in compression and cool in expansion? A.—Air, in common with other substances, expands when heated and contracts when it is cooled. A gas expands $\frac{1}{273}$ of its volume for every degree of temperature (centigrade) which it receives, and it contracts $\frac{1}{273}$ of its volume for every such degree taken from it. If air is compressed there is mechanical work done to it which manifests itself in a rise of temperature, just as a chip of steel heats when being cut off in a machine. If you were able to reduce the air, without compression, to the same volume as it had after it had been compressed, you would have to do it by cooling, or by taking heat from the air. If you then wished to expand it to its original volume you would have to give it the quantity of heat necessary to bring about that amount of expansion. A volume of air might be compressed and so heated, and, while under compression, cooled to its original temperature. If it was then allowed to expand it would take from the walls of the containing vessel or from external objects the amount of heat which it would have lost if it had been reduced to that volume by cooling.

Traveling Engineers' Convention.

The Traveling Engineers' Association meet in convention at Chicago on September 8, and there is every indication that they will have a successful and interesting meeting. We confess having a weakness for the meetings of this association, for it is composed mostly of men who have come to their positions through a process of searching selection that few other bodies of men have gone through. The greater part of them have been successful engineers, and most of them have been promoted because they were first class engineers and had the faculty of managing men and instructing them in their duties, if necessary.

The traveling engineer was a product of necessity, as recognized by the most enterprising class of railroad managers. A great deal of heat was wasted by engineers working their engines in a careless way regardless of any idea that it was his business to make the engine do its best, and firemen frequently used coal as if it cost nothing. The most successful method adopted to close up the leaks arising from these sources was in the appointing of live progressive men as traveling engineers, men who had interested themselves in doing their work well, and had the capacity for instructing indifferent engineers and young firemen. We have repeatedly heard general managers and superintendents of motive power admit, after traveling engineers had been performing their duties for a few months, that the expense incurred for salaries of traveling engineers was among the best investments their companies had ever incurred.

There have been, however, many failures in the appointment of traveling engineers. When the oldest engineer was appointed, or the loudest talker, or the man most popular with the other engineers, without strict consideration of his fitness, as was often done, the company reaped little or no benefit from his services, and he was frequently a source of discord.

To make a success a traveling engineer must be intelligent enough to be the master of his business, which will compel the respect of the men he is going to influence and control. He must have clear ideas of how firing should be done to make the greatest possible amount of steam per unit of coal burned. He must know how steam ought to be used in the cylinders to convert all the heat possible into the mechanical work of taking a train over the road, and he must understand all the mechanism of the engine and train so thoroughly that any failure or disorder may be at once understood.

These attributes and attainments the successful traveling engineer possesses; but to make a success he must have ample authority that no one has a right to question. Without this authority the traveling engineer might as well relinquish his position.

There is a movement to change the name of the Traveling Engineers' Association to that of Road Foremen of Engines Association. We do not think that much gain or loss would be effected by the change so long as it is the same band of bright practical men who compose the organization.

We hate puzzles and riddles and all those trifling things that require strenuous guessing, but the Joseph Dixon Crucible Co., of Jersey City, N. J., have sent out a movable puzzle called "Figure it Out," which is really amusing. We advise our fun-loving readers to send for the "Figure it Out" and figure it out faithfully without tearing open the slide to give premature revelations.

Air-Brake Department.

CONDUCTED BY F. M. NELLIS.

A Neat Air Driven Machine.

The accompanying cut shows a neat stand (1) supporting a small air motor (2) which drives a shaft on which is arranged a cast iron balance wheel, a small grindstone (3), a metal circular saw (4) (1-32 in. by 3 in.) which is used principally to split metallic piston rod and valve stem packing rings as shown, and on the end of the shaft is a small chuck which is used to grind valves in angle cocks as shown at 5; also air valves, etc. This is a machine in the shops of the New York, Susequehanna & Western Ry. at Stroudsburg, Pa., to whose officials we are indebted for this illustration.

Changes in the Westinghouse Traveling Force.

Mr. I. H. Brown, until recently chief air-brake instructor of the Westinghouse Air Brake Co.'s instruction Car No. 1, has been promoted to traveling inspector of the Cincinnati district. Mr. Hutchins leaves this district to give his entire attention to triple valve repair work. Mr. S. H. Down succeeds to the chief instructorship of the W. A. B. Co.'s instruction Car No. 1, and Mr. Harry Orchard, for some time past air-brake instructor and inspector for the Erie Railroad at Huntingdon, Ind., has accepted the position of assistant instructor to Mr. Down.

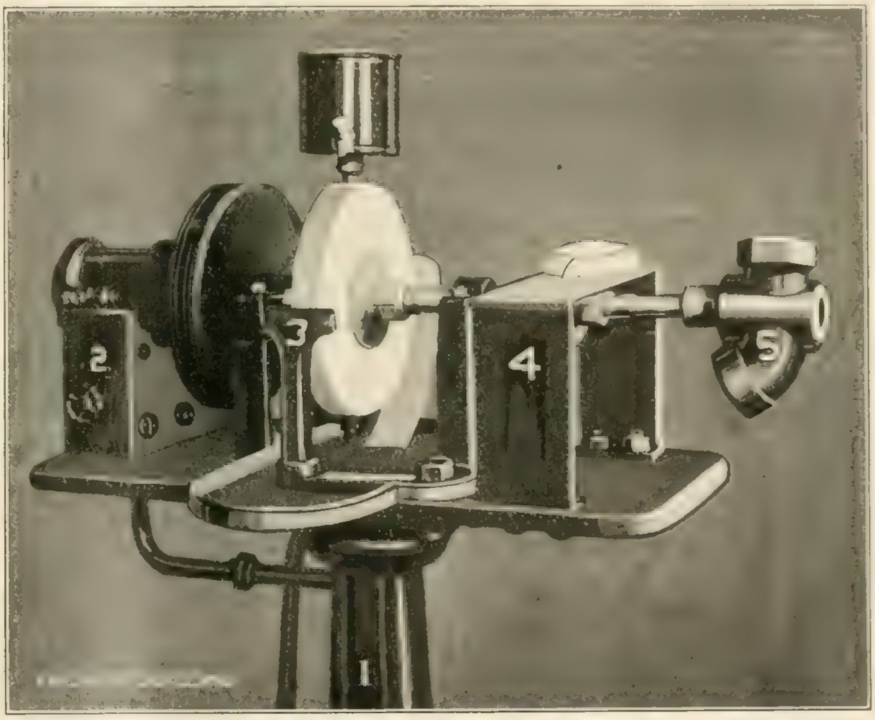
Fifty Per Cent Air-Braked Freight Trains.

On September 1, 1903, the new amendment to the automatic coupler and power brake law goes into effect. This amendment is broader and covers the ground more thoroughly than did the law itself. The law required that railroad companies should have sufficient air-brakes in each train in interstate traffic to permit the engineer to safely handle the train. The amendment requires that the train shall not only contain sufficient brakes for the engineer to safely handle the train, but goes further and makes it obligatory to have 50 per cent. of the cars in the train equipped with air-brakes, coupled up, and in operation under the engineer's control. Thus, the object sought, which is to have freight trains under air-brake control, is reached in the amendment better than by the law itself, as the law contained a loop-hole which permitted but a few air-brake cars, out of many available ones, to be coupled up.

A Pioneer Air Brake Man Gone.

"Harry" Frazer died suddenly at his home in San Francisco, July 21. Mr. Frazer was apparently in excellent health, and the news of his death comes suddenly and with great shock.

Mr. Frazer was born and reared at Lancaster, Pa., where he graduated from the high school, and being of a mechanical turn of mind entered the machine shops of the Pennsylvania Railroad at that place to learn the machinist trade. After serving his apprenticeship he went to Pittsburg, where, in time, he became assistant foreman to "Nick" Johnson, now deceased, in the Pan Handle round house.



A VERY NEAT AIR MOTOR AND MACHINE.

It was while in this capacity that Mr. Frazer came to the notice of Mr. George Westinghouse, who was then struggling to bring the air brake into successful existence. It was here that Mr. Frazer did his first air brake work by assisting Mr. Westinghouse to convert an old Worthington water pump, with leather packing, into an air pump. Shortly afterwards Mr. Frazer regularly entered the employ of Mr. Westinghouse, who was then starting a small factory in Pittsburg, at Liberty avenue and Twenty-eighth street.

Mr. Frazer was one of the first traveling inspectors sent out on the road by the Westinghouse Air Brake Co. He went to California early in the 80's to introduce the automatic brake on freight trains in mountain service. This work was of an initiatory and a very important character, as air brake control of freight trains had up to that time never been attempted on any mountain railroad. Going to the mountainous districts, where absolute control at all times was so necessary, Mr. Frazer realized that upon him personally devolved the immense responsibility of laying the ground work for the success or failure of air brake freight train control. Slowly he began to make headway, and railway people began to realize that the Westinghouse air brake was not only adapted to passenger train service, but that it had an equally great, and even greater, value in control of the freight trains, especially on mountain grades, where at that time four and five brakemen were required to successfully drop a train down a heavy grade.

The constant application and faithful services of Mr. Frazer in these early days did much to place the automatic air brake where it is to-day, for no trip

was too long or fraught with hardships for Mr. Frazer to undertake and carry out. He became the trusted instructor and air brake manipulator of engineers and trainmen with whom he became so well known by close association, and also with the officers of the road, who held him in especial high esteem and confidence. After a successful experience with air braked freight trains on the heavy grades in the far West, Mr. Frazer was called East to participate in the Master Car Builders' Burlington trials, in 1886 and 1887, where his advice and suggestions availed his company much.

In later years Mr. Frazer was privileged to enjoy the fruits of his early labors on the Pacific Coast, having lived to see the day when not a car was allowed to enter any of the Pacific Coast or Rocky Mountain roads unless it was equipped with an air brake, and no train permitted to move on these roads unless the entire train was so equipped.

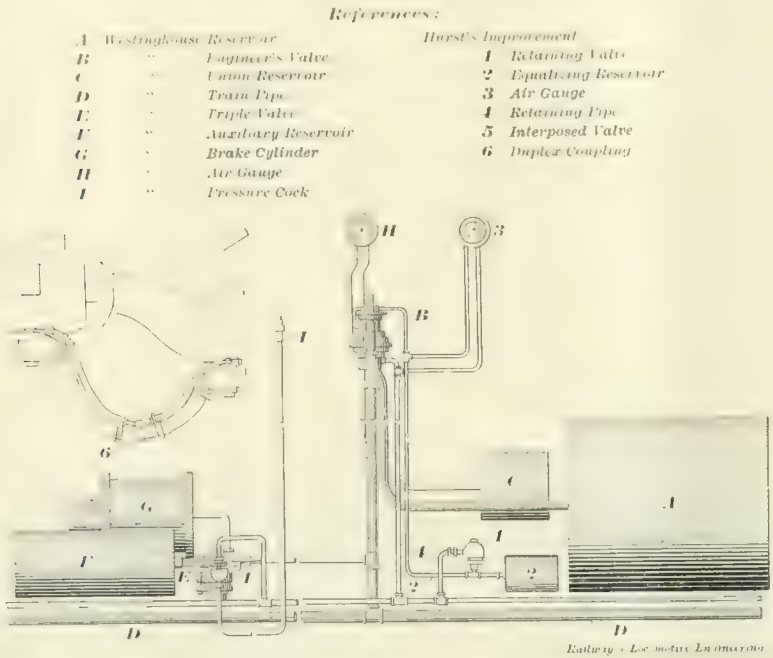
Mr. Frazer was the oldest traveling inspector in the service of the Westinghouse Air Brake Co.'s employ, and was held in high esteem by both his official and employee associates. No man was more popular or better known throughout the air brake world than he, and the passing out of no air brake man will be more generally and sincerely regretted than that of "Harry" Frazer.

The Hurst Automatic Retainer.

The Hurst improvement is an automatic retainer designed for the purpose of holding the brake set while recharging the auxiliary reservoirs, to equalize the brake pressure, to make a gradual release, to make stops on grades, to show pressure used in brake cylinders and especially to hold trains on long, heavy grades, and street-car service where stops are frequent; also for a high-speed brake.

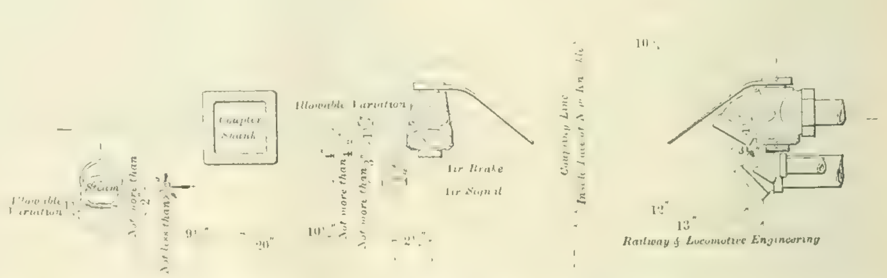
The valve used (Fig. 1) is a hollow casing separated by a diaphragm in two compartments and controlled by the exhaust air. The casing is in two parts and is screwed together, holding the diaphragm between the joint. The diaphragm has a stem through its center which seats on an exhaust port in the casing. There are two other openings in the valve casing. They are for the admission of air, one on each side of the diaphragm. To connect the retaining valve to the engineer's brake valve, you must attach the side having one opening to the exhaust port of the brake valve reservoir. There is also attached here a small reservoir and one side of a duplex gauge. The other side must be attached to the train pipe exhaust port of the brake valve. This side of the retaining valve has the exhaust port in it and is connected to the cars by a pipe that extends throughout the train. It has the other side of the duplex gauge attached also.

This is the equipment for the engine. On the cars the retaining valve is attached to the exhaust port of the triple valve by the same opening that is screwed into the train pipe exhaust port of the brake valve. This side of the valve has the exhaust port and receives the air from the brake cylinders. The other side is attached to the retaining pipe that comes from the engine and receives the air from the train pipe exhaust port of the engineer's brake valve.



THE HURST AUTOMATIC RETAINER.

The small reservoir used on the engine should be about one-half the size of the brake valve reservoir, as this reservoir gets its air from the brake valve reservoir when the application is made, and being one-half the size, we would get two pounds' pressure for one pound exhausted. The pressure obtained here governs the train. Then a seven-pound reduction would give fourteen pounds' pressure in the small reservoir and one side of the valve and guage, and pushing the diaphragm and stem and closing the exhaust port in the other side with the fourteen pounds' pressure. The air from the train pipe exhaust port goes in to the valve on the side of the diaphragm that has the exhaust port, but the port being closed with the fourteen pounds' pressure from the other side, the air goes to the gauge and retaining pipe that extends throughout the train, closing the valves on the cars with the fourteen pounds' pressure. If the retaining pipe gets more than the fourteen pounds it moves the diaphragm, opens the exhaust port, and the excess pressure passes out. All the retaining valves on the cars are closed with the fourteen pounds' pressure. This allows the engineer to place the brake valve in the recharging position and charge up the auxiliary reservoirs. The brake cylinder, having more than fourteen pounds' pressure, will move the diaphragm, open the exhaust port in the retaining valve, and the excess pressure will pass out.



M. C. B PROPOSED LOCATION FOR STEAM HEAT, AIR BRAKE AND AIR SIGNAL PIPES AT END OF PASSENGER EQUIPMENT CARS.

The engineer's brake valve must have a port in it for releasing the air from the retaining valve and small reservoir. The opening should be very small so that we can reduce one pound if desired, for every car will reduce the same as the engineer reduces the pressure on the retaining valve in the engine.

CORRESPONDENCE.

Not Service, but Emergency Only.

In the July number Question 54, page 321, I note a mistake. It says: "He can also apply brakes in service position as well as in emergency if he desires."

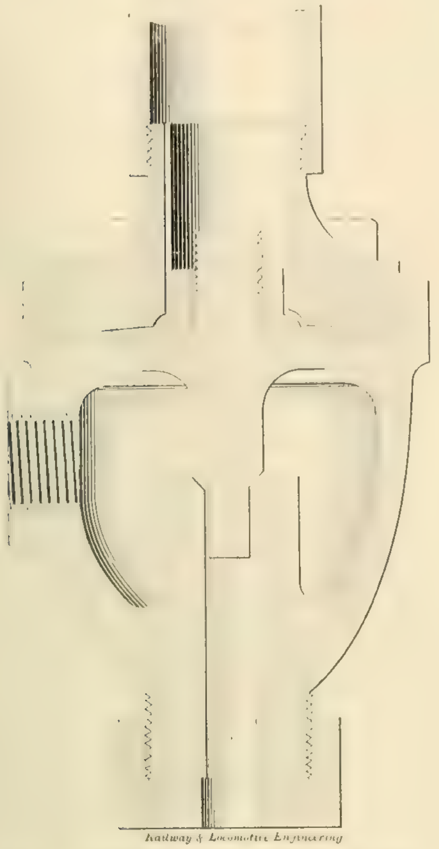
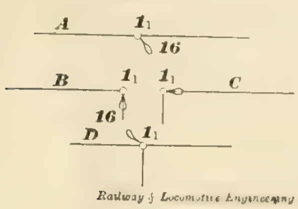


FIG. 1. HURST AUTOMATIC RETAINER.

With the P. R. R. cut-out cock closed the train line exhaust is closed and brakes cannot be applied in service position. If brakes are to be applied by the second engineer it must be done by using the direct application port. The copper pipe leading from the train line pipe to end of cut-out cock supplies air to keep rotary valve seated when cock is closed, as main

Fig. 6



reservoir air has been cut off. The other small copper pipe coupled to angle fitting at brake valve and to cut-out cock is for the train line exhaust.

C. L. MILLER,
Harrisburg, Pa. Engr. P. R. R.

[An oversight by us. Our correspondent is correct.—Ed.]

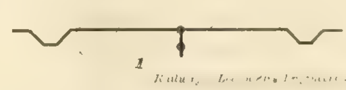
A Recently Patented Four-Way Cock.

I have just been granted a patent which relates to certain new and useful improvements in four-way cocks adapted for use in connection with an air-brake train line.

In the accompanying drawings I have illustrated my improved four-way cock as follows:

Fig. 1 is a plan view of my four-way cock. Fig. 2 is a side view. Fig. 3 is a sectional view on line X X of Fig. 1. Fig. 4 is a sectional view on line 5 5 of Fig. 2. Fig. 5 is a view showing the application of the invention to a train-line, and Fig. 6 represents diagrams showing the various service positions.

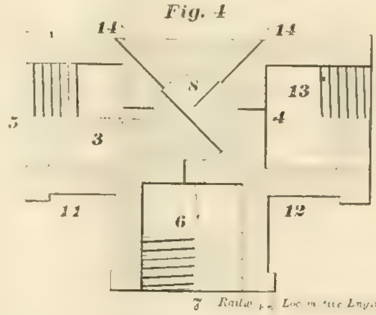
Fig. 5



In the drawings the numeral 1 designates the shell or casing having a tapered opening 2 therethrough, and air-passages or ports 3 and 4 communicating with the said opening and train-line connections or ends 5, and a similar port 6 communicating with said opening and triple valve end 7.

A tapered plug-valve 8 is fitted into the tapered opening of the casing and is held in position by a spring 9 and cap 10. The plug-valve is provided with a side or cut-away part 11, straight-away part 12, and part 13 branching from said straight-away part, which parts are

Fig. 4

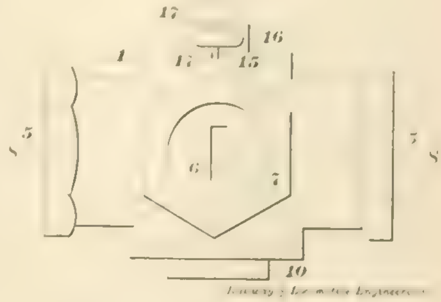


adapted to register with the parts in the casing and with the dead-air ports 14.

At the upper end of the casing is found four stop-notches 15, and to the top of the plug is attached a handle 16, which is provided with a spring catch 17 to engage said stop notches. Said spring and notches serve to indicate the position and retain the cock in such position.

In practice the train-line is connected to the ends 5 and the pipe leading to the triple valve to the end 7. If it is desired to let air from the train-line on the left to the triple valve, the cock is turned into position shown at Figs. 1, 2, 3 or 4 and at B of Fig. 6. To let air from the train-line into triple valve at right, the cock is turned one quarter, as at C, Fig. 6. From both cars to triple the cock is as at D, Fig. 6, and for straight-away train-line as at A, Fig. 6, the stop-spring

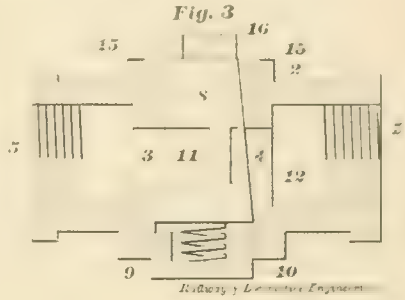
Fig. 2



17 and notches 15 holding the cock at any position to which the same may be turned.

This device does away with several independent cocks on the train-line, and the dead air remaining in the parts escapes out of ports 14. By the "expansion dead air" it will be understood is meant the air which remains in the pipes under pressure and which it is desired to release when the air is not required for

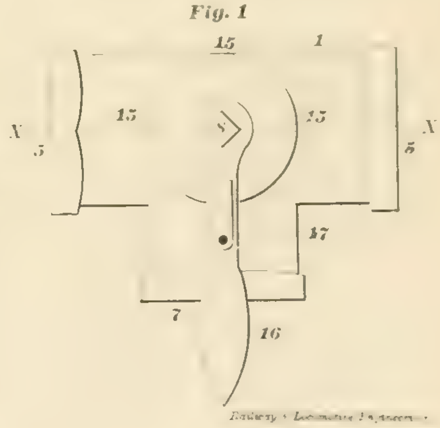
Fig. 3



service, and which air is released to remove the pressure from the parts of the cock and connected mechanism.

PATRICK MCDONALD.
Pittsburg, Pa.

Fig. 1



Port Arrangement in Cylinder Gasket for 9 1-2 Inch Air Pump.

The accompanying sketch is submitted with the idea of trying to overcome the breaking away of the steam ports in the upper steam cylinder gasket for the Westinghouse 9½ in. air pump. The ports as dotted represent the gasket as at present in use, and the full line at each

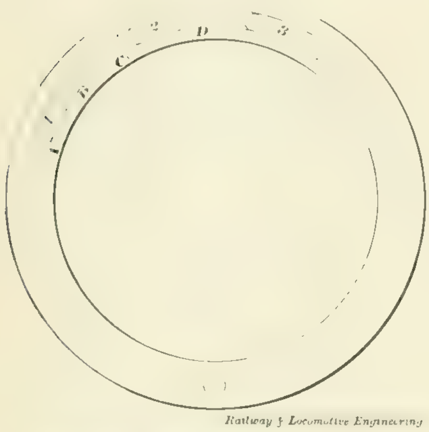
end of the ports represents the suggestion.

This gasket has always been a source of considerable annoyance, by breaking away of that portion between the broken lines A and B in the steam port (1) and C and D in the steam port (2), because of the fact that the corners of the ports are brought to an acute angle, which weakens the gasket when it should be designed to withstand a high pressure, as it does. This portion in the exhaust port (3) seldom breaks because the pressure is low and the strain is not so severe on that part of the gasket.

Over 50 per cent. of the gaskets removed from our pumps at Burnside are broken as shown at the broken line in the sketch, and consequently unfit for further service, when if the corners of the gasket were arranged as shown, the breaking would be reduced to a very small per cent.

WILL W. UP DE GRAFF.

Chicago, Ill.



PROPOSED MODIFICATIONS IN TOP HEAD PUMP GASKET.

1901 Model New York Pump Governor.

A certain fixed limit for train pipe pressure must always be maintained in order that the proper braking force to suit the conditions under which the brakes are being operated, may always be available.

By opening the air pump steam throttle, steam is admitted to the pump, and the latter starts to work, but without some automatic steam regulating device the pump would continue to pump air into the main reservoir until the pressure therein became nearly as high as the steam pressure on the boiler of the locomotive, unless the engineman should attend to the task of regulating by hand the supply of steam admitted to the pump. To do this it would be necessary for him to watch the air gauge very closely, closing down the steam throttle when the air pressure reached the required limit, and then, when the air pressure fell below the required limit, opening it again.

It can easily be seen that hand regulation of the steam supply to the air pump would require considerable of the engineman's attention, and that, too, sometimes when his attention should be given elsewhere to other more important matters.

Therefore, to relieve him of the necessity of regulating the working of the air pump, and to insure a uniform air pressure in the main reservoir and the train pipe at all times, an automatic steam regulating device, called the pump governor, is placed in the steam pipe, between the pump steam throttle and the pump, whose duty is to shut off the steam from the pump when the required air pressure has been obtained in the main reservoir and the train pipe, and to admit the steam to the pump again as soon as the air pressure falls slightly below the required limit.

The accompanying illustrations, Figs. 1 and 2, show the 1901 Model New York pump governor, with the steam valve open and with it closed.

It may be well to state here that the rate of speed at which the pump is to work must be determined by the engineman, and provided for in the amount of opening he gives the steam throttle; the pump governor simply determines the point in the air pressure at which the steam is to be shut off from the pump, and again admitted to it.

The operation of the governor is as follows: steam being turned on, it passes through the steam valve body, 1, on its way to the air pump, in the manner and direction indicated by the arrows, and as it does so, raises, and holds up steam valve, 5, in the position shown in Fig. 1.

As the air pump accumulates air in the main reservoir and the other parts of the air brake apparatus, air pressure forms in diaphragm air chamber, A, on account of the air flowing into this chamber through the air union connection at 17 and 18, as indicated by the small arrows.

It will be observed by reference to Fig. 1, that the regulating spring, 10, holds diaphragm button, 12, and diaphragm air valve, 13, firmly to the air valve seat, 14, preventing communication between chamber A and B.

The tension of the regulating spring, 10, is either increased or diminished by screwing down or in screwing up the adjusting screw, 8, and is always made sufficient to prevent diaphragm air valve 13 from being lifted from its seat until the required air pressure in the main reservoir and the train pipe has been obtained.

When the air pressure in chamber A, pressing upwards against diaphragm air valve, 13, is sufficient to overcome the tension, or resistance, of regulating spring, 10, the diaphragm air valve lifts, and air flows past it down into chamber, B, as shown in Fig. 2.

Air being admitted to chamber B, forms a pressure in this chamber which acts on the governor piston, forcing the latter together with the steam valve, 5, upon which it rests, downward until the steam valve is seated, as shown in Fig. 2, and thus the pump governor cuts off the supply of steam to the pump, causing the latter to stop momentarily.

When the air pressure in chamber, A, reduces in pressure sufficiently to allow the regulating spring, 10, to seat the

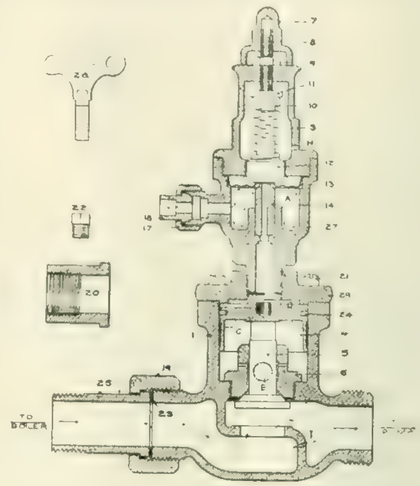


FIG. 1.
NEW YORK PUMP GOVERNOR OPEN.

diaphragm air valve, 13, communication between chambers A and B is cut off, and the air remaining in chamber B quickly escapes to the atmosphere through the small relief port, indicated by the dotted circle in the passage connecting chamber A with chamber B, relieving the pressure in chamber B. When this occurs, the steam valve, 5, which is being acted upon by the steam pressure beneath it, and the governor piston, 4, are raised to the up-

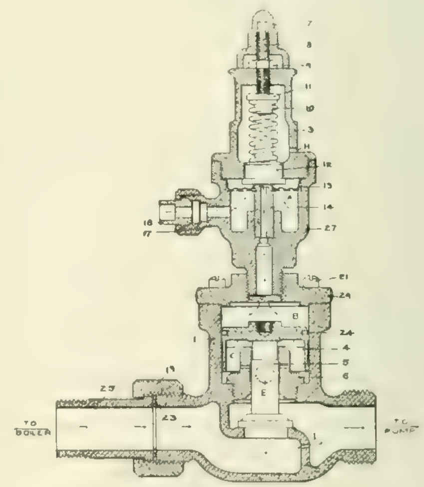


FIG. 2.
NEW YORK PUMP GOVERNOR CLOSED.

per point, or extremity of their travel, and steam is again admitted to the pump starting it to work again as shown in Fig. 1.

Port H relieves all pressure above diaphragm air valve, 13, that might form in the spring case, 3, due to leakage from chamber, A, and thus prevents possibility of governor, on account of such leakage, allowing too high air pressure to accumulate.

The small port, I, is provided for the purpose of supplying a small quantity of steam to the pump, sufficient to keep the latter moving, while steam valve 5 is on its seat, thus providing a circulation that prevents condensation of steam in the steam pipe, and in cold weather prevents freezing up of the pump.

There are several combinations of the pump governor to suit particular kinds of service, such as the single, the duplex, and the triplex governor. These together with the defects to which the governors are occasionally subject, will be treated in another article. J. P. Kelly.

Watertown, N. Y.

QUESTIONS AND ANSWERS

ON THE AIR BRAKE

(65) S. J. B., Trenton, N. J., writes:

I have noted that on one of our high-speed trains coming to a stop there was a hissing noise of the triple valve which finally went into the well-known sound of the triple valve releasing the brake. I would ask what makes this peculiar release with the high-speed brake? A.—This hissing sound is probably the pressure reducing valve of the high-speed brake releasing brake cylinder pressure, due to a full service application, and while the reducing valve was still blowing the engineer released the brake, thus stopping the discharge at the reducing valve and creating a new one at the exhaust port of the triple, the sound with which we are all quite familiar.

(66) J. C. M., Packerton, Pa., asks:

How do you tell the difference between a leak from the auxiliary reservoir into the brake cylinder and one from the train line to the auxiliary? A.—Train pipe pressure leaking into the brake cylinder, past the rubber seated emergency valve, the gasket between the lower case of the triple valve and the main body, or any other passageway, will be manifested by a blow at the exhaust port of the triple valve the instant pressure is turned into the train line. However, if the leak be one from the auxiliary reservoir into the brake cylinder, past a leaky slide valve, broken gasket between the auxiliary reservoir and brake cylinder, or defective tube in the auxiliary reservoir, this leak will be manifested by a very slight leakage as pressure is first turned into the auxiliary, but gradually increasing as the auxiliary reservoir charges up.

(67) P. S., Frankfort, Ind., writes:

In the February issue of Railway and Locomotive Engineering I saw a cut of an automatic sight feed lubricator for the air cylinder of the air pump. Do you think they are a great enough advantage over the ordinary cup now in use to make them advisable? A.—The service of the air pump on long trains of to-day is much more severe than formerly with shorter trains. Doubtless the old form of cup was adequate and suited to that service, but not so well suited to the heavy service of to-day as is the regular feeding automatic cup. The sight feed feature doubtless aids the engineering considerably in advising him whether the cup is feeding, and when it has fed out. Undoubtedly, experience to date has proved that the automatic sight feed cup for the air cylinder of the air pump is a decided advantage.

(68) P. E. M., Murray Bridge, So. Australia, writes:

What is the advantage of placing the release valve of rolling stock air brake on the auxiliary reservoir? Some vehicles have this valve on the brake cylinder. I fail to see any advantage in the placing of this valve on the auxiliaries. By what I can see of it, it seems to me that the auxiliary attachment is rather to a disadvantage. A.—With the earlier forms of air brakes, the release valve was placed on the brake cylinder, but on account of it being left open so frequently after bleeding off the brake, thereby causing trouble and even expensive accidents, because its open condition was never known until the brake was applied, the release valve was removed and placed in the auxiliary reservoir. Now, when it is desired to release a brake with the release valve, the triple valve is made to move to release position, and the brake releases in the natural way, which is much quicker than if the release was made with the brake cylinder, where both the brake cylinder air and the auxiliary reservoir air sometimes have to be reduced to release the brake.

(69) B. C. G., New York city, writes:

There are some complaints from one or two of the motormen of the Manhattan Elevated road saying that some sort of mufflers had been put in the exhaust ports of the triple valves, which results in making the air escape from the brake cylinder so slowly that it sometimes takes the control of the train away from the motorman. A.—The muffler placed in the exhaust port referred to is an ordinary pipe plug with a hole about 3-16 of an inch in size through it. This plug not only muffles the sharp whistling sound of the triple valve, but retards the discharge of pressure from the brake cylinder. It has been found necessary to retard and lengthen the exhaust because of the very short piston travel on these cars, the travel being between three and four inches. With this travel the air escapes so suddenly that it is very difficult to make a smooth stop. The lengthened exhaust acts more like a longer piston travel, and permits the train to be brought to a standstill with greater accuracy, at the same time avoiding the disagreeable shock experienced with the short travel and wide-open exhaust.

(70) J. R. McE., Little Rock, Ark., asks:

Why does the slide valve feed valve attachment on some brake valves allow the pressure to creep up above 70 pounds what it is set for, and equalizes at 90 what the main reservoir pressure is set for? A.—The diaphram valve may be held from its seat by foreign substance or the slide valve or its seat be cut, thus permitting main reservoir pressure to leak into the train pipe. Again, the lead gasket between the brake valve body and the feed valve attachment may leak, causing the same trouble. Sometimes, in truing up of the slide valve seat, no heed is taken that the seat be kept parallel with the floor and roof of the piston's cylinder. The slide valve, fitting snugly between the shoulders of the piston stem, tends to slightly lift at one end or the other, thus tipping it and permitting main reservoir pressure to feed slowly under it into the train pipe. Sometimes, in screwing home the cylinder cap, the spring is twisted, and transmits the twist to the piston, which slightly tips the side of the slide valve from its seat, permitting main reservoir pressure to leak under the edge into the train pipe.

(71) P. E. M., Murray Bridge, So. Australia, writes:

I start the pump and accumulate 80 pounds in the main reservoir, and having handle of driver's valve in release and full-charge position, I understand that both pipes (train and reservoir) contain an equilibrium of pressure. Now I put the handle in running position and a decrease of 8 to 10 pounds train line pressure is shown by the gauge pointer. Why is it? Our engines are fitted with the old-type driver's valve with 10-pound reserve valve, and all plain triples. A.—If the train line pressure drops when you bring your brake valve handle from release to running position, there is a leakage of pressure from the train pipe at some point. If the main reservoir pointer goes up, and the train line pointer stands still, there is no leakage in the train pipe, and the difference between the two hands indicates merely a rise of pressure in the main reservoir. If, after coupling the engine to the train, with the handle in full release position, the black pointer drops and continues to drop when the handle is brought to running position, it shows that pressure is passing into the train pipe in full release position faster than the feed groove in the triple valves can take the pressure from the train line. When the handle is returned to running position, and the black pointer falls again, it shows that the feed grooves at the triple valves are taking train line pressure faster than it can be supplied by the running position of the brake valve.

Lining of Shoes and Wedges.*

BY W. D. CHAMBERLIN.

The following method of lining up shoes and wedges is, I think, safe and practical if properly carried out. It has been used for years in one of our railroad repair shops, and gives satisfaction, having been much used on repair work where the old center lines and marks are worn off or cannot be depended upon, so that new and reliable lines have to be laid out.

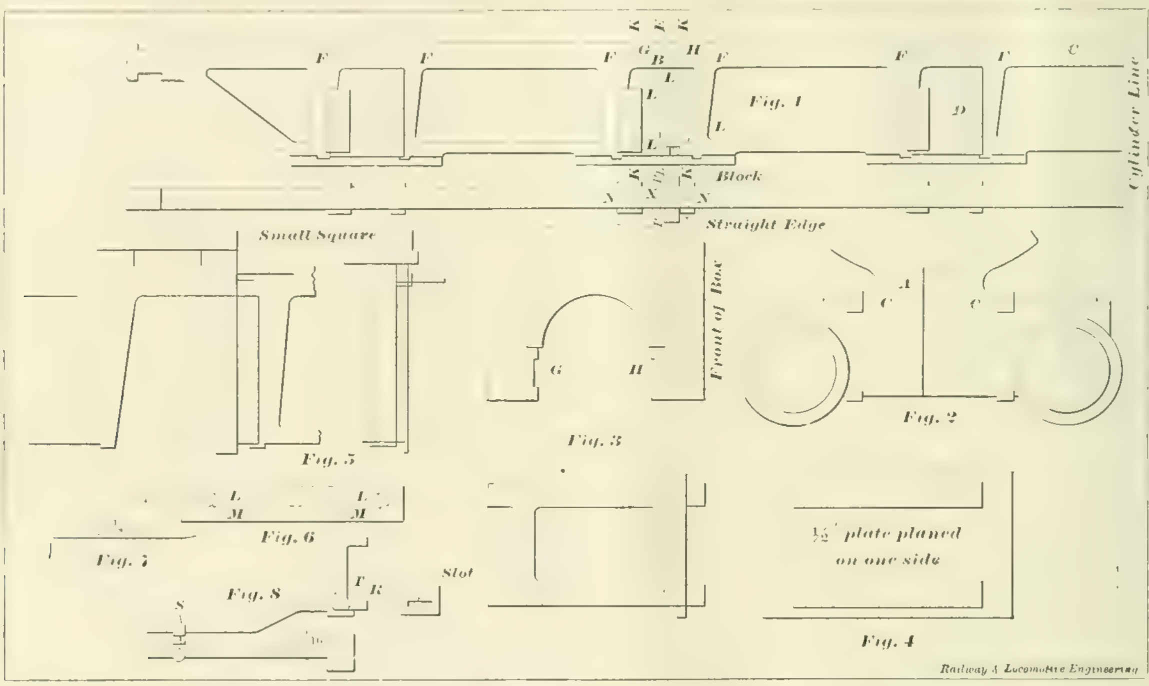
In lining up shoes and wedges the utmost care should be observed when laying off distances or taking measurements, as the accuracy of the finished work depends, of course, upon the care which has been taken in doing it. This is true of most machine shop work, but particularly so with shoes and wedges, the face or surface, which bears against the driving box. This is left rough until properly laid out.

On the side of the frames over each jaw lay off short lines *F F*, Fig. 1, parallel to and equally distant from the top of frames. When this is done, a point *A*, Fig. 2, on back of cylinder saddle equally distant from each frame and down a convenient distance from the boiler, must be located as follows: Lay off a point *C*, Fig. 1, on the inside of each frame near the cylinder, the distance from the finished surface *D* of the front jaw being the same on both frames, and the distance down from the top of frame also being the same on both frames. Mark this point lightly with a prick punch. Now get a piece of ¼-inch wire and bend it as shown in Fig. 7, the end bent being about 1 inch long. Cut the wire off long enough so that it will reach from the point *C* to where point *A* will come, then sharpen both ends. Place the point of straight end at *C* and with bent end scribe a line on cylinder saddle about where *A* will come, then do the same on the other frame. Where the two lines cross will be the point *A*, midway between the frames. Before locating *A* it is best to chip off the rough casting at that point and make a smooth surface to work on. Mark the point *A* with a prick punch. Now go to the right main jaw and lay off its center line *E E*, intersecting *F F* at *B*, Fig. 1.

It is best to use the main jaws to work from, but if they are unhandy to get at, use the front jaws. Take a long "fish" tram with one movable point; place the pointed end at the point *A* on cylinder saddle and set the movable point at *B* on the frame (right main jaw), the intersection of *E E* and *F F*. Take the trams to the left side of the engine, leaving it set at this distance, place the pointed end at *A* as bfore, and with the movable point scribe a line on side of frame over left main jaw, intersecting *F F*, thus locating at this point of intersection a point corresponding to *B* of the right side. Through this point scribe a line at right angles to the top of frame. This line is the center line of that jaw and corresponds to *E E* of right side.

In some cases the guide yoke or other parts interfere so that the movable point of the trams cannot be set at *B*. In such cases continue the center line *E E* across top of frame by means of a square set to *E E*, the blade extending across top of frame. On this line locate a point a certain distance from edge of frame, say midway between edges, and set the tram point to this point. Take the trams to the left side of the engine, place the point at *A* as before, and with movable point scribe a line on top of frame. Now lay off the line *N N*, shown on plan view of Fig. 1, midway between edges of frame and intersecting the line scribed with trams at *X*. Scribe the line *P P* through *X*, across the top of frame, and continue it down the outside by means of a square. This latter line then is the center line of that jaw (the left main), and corresponds to *E E* of the right side. Of the two methods just described for locating this center line, the first is the best and safest, and should be used whenever possible.

The "fish" trams mentioned may perhaps be strange to some machinists. It consists of a long rod (⅜-inch iron pipe is suitable) about 12 feet long, one end



LINING UP SHOES AND WEDGES, LINES AND POINTS REQUIRED.

work being simply a matter of taking and laying off certain measurements. The main object in view is to place the axis of the driving wheels and axels at right angles to the frames and parallel to each other, the distance from the axis of one pair of wheels to the axis of the next pair being the same as the length of the rod which connects them. There are other points which must be taken into consideration, but this is the principal one. In the first place, the frames, cylinders, boiler, etc., are supposed to be set up and firmly bolted into place. The pedestal braces should also be bolted into place. We will suppose the engine to have six drivers, the shoes and wedges being ready to set up, having been planed and fitted to the pedestal jaws, all planer work on them being finished except the

* Reproduced by request, from RAILWAY AND LOCOMOTIVE ENGINEERING of February, 1900.

being drawn out to a rather blunt point. One ordinary tram point is used, it being provided with the usual set screw so as to set it at any position on the rod.

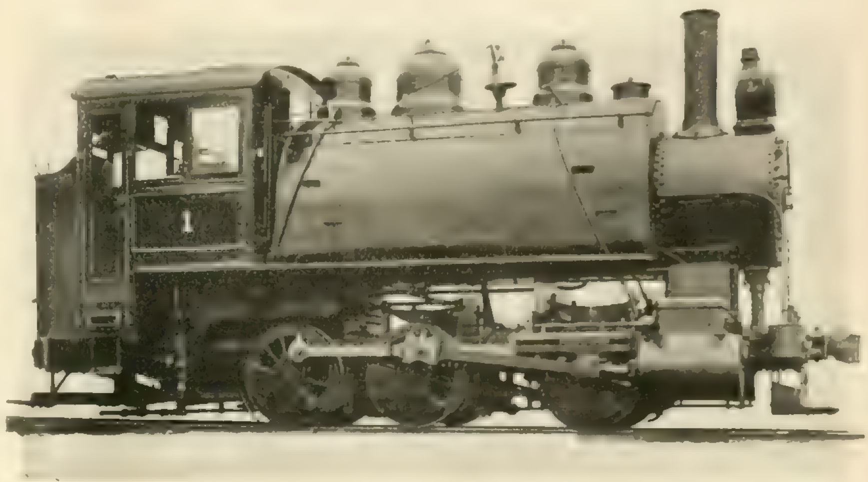
To continue with our work: We now have the center lines of the right and left main jaws. Now take an ordinary double-pointed trams and carefully set them to the length of the side rods which connect the main drivers to the front drivers (it will be remembered that our engine has three pair of drivers, the middle pair being the main), place one point at B on the right main jaw of engine, and with the other point scribe a line on the side of frame over the right front jaw, intersecting F F. This point corresponds to B on the main jaw. Through this point scribe a line at right angles to the top of frame. This is the center line of that jaw. With the trams set at same distance, go on the other side of engine and repeat the operation for the left front jaw. Now set the trams to the length of the side rods which connect the main drivers to the third pair of drivers, and repeat the same operation for the third pair of jaws. We now have the center lines E E of all the jaws. The utmost care and caution should be taken in this work, as a large pair of trams can very easily play tricks on the man who handles it. The work should be gone over with again in order to prove its accuracy.

The next thing to do is to consider each driving box, which should by this time be ready to set up, the machine work on them being finished. The boxes are supposed to be bored out central; *i. e.*, $G = H$, Fig. 3. They are, however, not always bored central, owing to faults of workmanship and other causes, so it is best to take this into consideration.

Take a box, say the right main one, get the distance H from the center of the brass to the front bearing surface, and lay it off on F F of the right main jaw, measuring to the front from the center line E E, thus locating point H^1. Do the same with G, measuring back from E E and locating G^1 on F F. Take each box and repeat the operation for its corresponding jaw. These points H and G show the exact position which the box should occupy in its jaw. By doing this the center line of the box will be kept at the center line E E of its jaw, no matter if the box is not bored out central. To get G and H take a piece of lead or a piece of wood with a tin strip set in its surface and place it between the sides of brass bearing, then take maphrodite calipers and locate the center of the brass bearing on this lead or wood piece. A ½-inch plate planed on one side and cut out to the shape shown at Fig. 4 should now be made. This can then be set on the bearing surface of the box, the plate projecting over the side of the box as shown in the plan view of Fig. 3. The distance H or G can then be obtained by measuring from this plate to the center of the brass previously located on the strip of lead. The plate should be made so that it can be used on any ordinary box. It can then be used on any job of shoes and wedges.

To return to the frame: We have now located on each jaw the position which its box will occupy. Now take each shoe and set it up in its place on the jaw, the set bolt being set up tight, thus holding the shoe firmly in position. The line K K, passing through H and parallel with E E, must now be scribed on the outside of the shoe. In order to do this, place two parallel strips across the top of frame, the ends projecting over the edge of the frame. Take a large square and set it on these projecting ends, with the blade hanging down at the side of the shoe; then take a small square, place the engine from frame to frame. Select two points L L on K K near the top and bottom of the shoe. Cut two [illegible] wooden blocks long enough so that when placed on the pedestal brace (one on each brace), with the straight-edge resting on them, it will come opposite the lower point L. Two blocks should also be cut [illegible] to reach the upper point L in the same manner. With the straight-edge resting on these smaller blocks, place [illegible] the same distance from L on each shoe. The plan of Fig. 1 shows one block and the end of the straight-edge as it rests against the shoe.

Now take your maphrodites and set them to the distance [illegible] straight-edge to L, which is equal on both sides of engine, then lay that distance off on the inside of the shoe with the leg of the maphrodites placed against the straight-edge. Do this on the other shoe on the other side of the engine,



ROGERS SWITCHER, WITH WIDE FIRE BOX.
Description on page 422.

it on the side of frame with blade at H, and move the large square until its blade touches the blade of small square. While doing this hold the small square firmly in place and keep the blade of large square pressed against the side of shoe, but be careful and not cramp it so that it will not rest evenly on the parallel strips. When the large square is properly located, take your scriber and scribe a line along its edge upon the side of shoe, thus locating line K K. In order to prevent the parallel strips from tipping off the frame on account of the weight of the square, place a piece of iron of sufficient weight upon them as they rest on the frame. Fig. 5 shows the arrangement of the squares and shoe. This operation should be repeated on all the shoes.

The next thing to do is to locate on the inside of the shoe a line corresponding to K K and at the same distance from E E. Take a long straight-edge and pass it between the jaws and across then place the straight-edge on the long blocks in the same manner and repeat the operation for the upper point L. Scribe a line through these two points just located on the inside of shoes. This line then corresponds to K K on the outside of shoe. Repeat this operation on all the shoes.

If the distance H is not the same on the opposite jaws it will be seen that the above operation is not theoretically correct, but unless the distance H varies greatly it is considered close enough for practice, the error being very small.

After all the shoes are thus laid out, they are taken down and planed to these lines. Before taking them to the planer locate with your dividers a point M, Fig. 6, a certain distance from L on the side of shoe—¾ inch is a convenient distance. It should be laid off from each point L, and a small circle described about it so as to make its position plain. After the shoe is planed, by measuring the distance from the planed surface to this point, it

can be seen whether the shoe was planed to the lines laid out. This is called a "proof" mark, because it is a means of proving whether the shoe was planed as laid out. If this mark is left off the planer hand can swear that he planed to the lines, and his word will have to be taken.

After the shoes are all planed, set them up in place again; also set the wedges in place on their respective jaws, the wedges being set at their lowest position. Now take a large pair of calipers and caliper the distance between the bearing surfaces of the right main driving box, *i. e.*, $H + G$, Fig. 3. A line K K parallel to the planed surface of the shoe must now be scribed on the wedge, both inside and outside.. The handiest and most accurate way to do this is by means of the tool shown at Fig. 8. This consists of a piece R, shaped as shown, the inside surfaces T and R being at right angles to each other. In this piece is screwed a 5-16-inch steel rod, with an offset and a movable point S. The side T has a slot cut in it for convenience in setting the point S to its proper position. Set the point S a distance from the surface T equal to the distance obtained by calipering the box.

Place the squared surfaces R and T against the corner of shoe, the surface T bearing against the bearing surface of the shoe, and the surface R bearing against the outside of shoe as shown. Now slide the tool down the shoe, holding it firmly with the point S against the side of the wedge. This scribes a line K K on the side of the wedge parallel to the planed surface of the shoe and at a distance from it equal to the distance between the bearing surface of the box. Do this on all the wedges both inside and outside, being careful to set the point S for each box, then take the wedges down, put on the proof marks and get them planed.

After the wedges are planed set them up in place again, then place the long straight-edge across from frame to frame as before, first rubbing its edge with damp lampblack. Place this edge against opposite shoes or wedges and rub it back and forth a few times, then notice how it bears on the surfaces. By this means it can be seen whether the bearing surfaces of opposite shoes or wedges are parallel to each other or not. To test the work in another way, caliper the boxes again and set the inside calipers and caliper the corresponding shoes and wedges. As a final test after the wheels are placed under the engine and wedges set up in place, the side rods not being up, go to each wheel and plug up the center holes made at the lathe, by hammering lead into them, then with dividers carefully locate the center of wheel, a circle for this purpose being usually cut in the hub of wheel when it is in the lathe; then lightly prick the center. Do this on all the wheels. Now set the large trams to the length of the side rod as before, place one point in center of main driving wheel, and try the center of the next pair of drivers with the other point.

It can then be seen whether the work is right or wrong. Try all the wheels this way with the trams set to the proper length. If the work has been carefully done, the wheels will undoubtedly come all right.

It will be noticed that the point G, Fig. 1 was not used in locating K K on the wedge. It is not necessary to lay in G, but it will do no harm to do so, as the position of K K on the wedge may be compared to it as a proof.

This method of lining up shoes and wedges, of course, cannot be used in all its details on some makes of locomotives, owing to their peculiar construction, but it will be found that it can be used on ordinary engines. For instance, in getting the line K K on the shoes by means of the squares and parallel strips, as described, it will be found that this cannot be done on the rear pair of jaws with those locomotives where the fire box sets on top of the frame. Instead of getting $K K$ in the manner described, it may be located by setting the large trams to the length of side rods, as before and tramming from K K of the main shoe, then K K of the wedge can be obtained as usual.

Automatic Electric Signals Introduced in Great Britain.

With a view to facilitating the working of their main line traffic to and from South Wales, the Great Western Railway Company are now arranging to install electrical automatic signaling through the Severn tunnel, which is 4 miles 600 yards in length. With the new signaling system the tunnel will be divided into sections of 1,200 yards length, thus permitting more than one train on the same line in the tunnel at the same time and with perfect safety. The usual semaphore signals at the sides of the line will be supplemented by "repeat" signals indicated in the cab of each locomotive before the eyes of the driver. This novel system, which is controlled by the Union Switch & Signal Company, can only be used in connection with electrical track circuit signaling, is in successful operation in the Park Avenue tunnel of the New York Central Railway, and, after a short initial experimental working on the Great Central Railway, has recently been approved by the British Board of Trade. Each locomotive is equipped with a reversing switch battery and two lamps, the latter being mounted in the cab of the engine. One of the lamps shows a white light, and the other a red. If the track is clear ahead, then the white light appears on the entering section. If the section is occupied the red lamp lights up, the white light going out. The system is stated to be absolutely trustworthy, and unaffected by climatic conditions.

Rogers Switch Engine.

The Rogers Locomotive Works, of Paterson, N. J., have recently supplied the New York Glucose Company with a six-wheel switcher, illustrated on page 421, which weighs altogether about 113,000 lbs., and all of this is of course, adhesive weight. The cylinders are 18x24 ins. and the drivers are 44 ins. in diameter. The pressure carried is 180 lbs., and the calculated tractive effort of this little machine is, therefore, about 27,000 lbs. and the ratio of tractive power to adhesive weight is, on this basis, 4.1.

The boiler is a straight top one, radial stayed 55 ins. in diameter at smoke box. It has a total heating surface of 1,134 sq. ft. The grate area is 30 sq. ft., the fire box being of the wide type set over the frames, and intended for small anthracite and bituminous coal. The saddle tank holds 1,700 gallons.

The total wheel base of the engine is 11 feet and the main drivers are not flanged. The valves are balanced slide valves, with ordinary indirect motion. Altogether the engine is a compact, neat looking and serviceable machine.

Lincoln's Car Sold.

The Union Pacific has sold the Lincoln car, which has been the property of the road for the last thirty-seven years, and it will be placed on exhibition on The Pike in St. Louis next year. For years the car has stood on the tracks near the Union Pacific shops at Omaha and it has attracted scarcely passing notice of Omaha people except when it was on view at the Trans-Mississippi exhibition. It was also exhibited at Chicago in 1893.

The car was built at the military car shops at Alexandria, Va., in 1864. It was ironclad, armor plate being set between the inner and outer walls to make it bullet proof. After the car was built the President used it practically altogether, and his remains were taken to Springfield for burial in it. In 1866 it became the property of the Union Pacific, and has only changed hands within the last month.

The proper place for this car is in the Smithsonian Institute at Washington. We hope it will go there when the St. Louis Exhibition closes.

Industry is the soul of business and the keystone of prosperity.

—*Barnaby Rudge.*

Electric Locomotive for the B. & O. Tunnel.

Probably the most powerful electric locomotive in the world has just been built by the General Electric Company at Schenectady, for the Baltimore & Ohio Railroad for use in its tunnel underneath the city of Baltimore. This locomotive marks a very distinct advance in electric locomotive design. It will handle all the freight traffic of the B. & O. which passes through Baltimore, and will operate over the same section as the present electric locomotives built by the General Electric Company and which have been in successful operation for the past eight years.

In designing this locomotive the specifications called for an electric locomotive capable of handling a 1,500 ton train, including the steam locomotive but excluding the electric locomotive on a maximum grade of 1½ per cent. at ten miles per hour, with corresponding higher speed on lighter grades. This required a locomotive weighing approximately 160 tons on the drivers for purposes of adhesion, and the engineers of the General Electric Company decided that the most practicable scheme was to build an articulated locomotive consisting of two complete 80-ton units operated together as one locomotive by means of the Sprague General Electric Multiple Unit Control.

The section of the road to be operated runs from Camden Street Station through the tunnel to the summit of the grade outside the tunnel a distance of 3½ miles. Under practical operating conditions the motors have sufficient capacity to maintain this service hourly running loaded up the grade and returning light.

DOUBLE ELECTRIC LOCOMOTIVE FOR THE B. & O.

Train Conductor Sold Fish.

A newspaper man recently found the following item in a New York paper dated 1858:

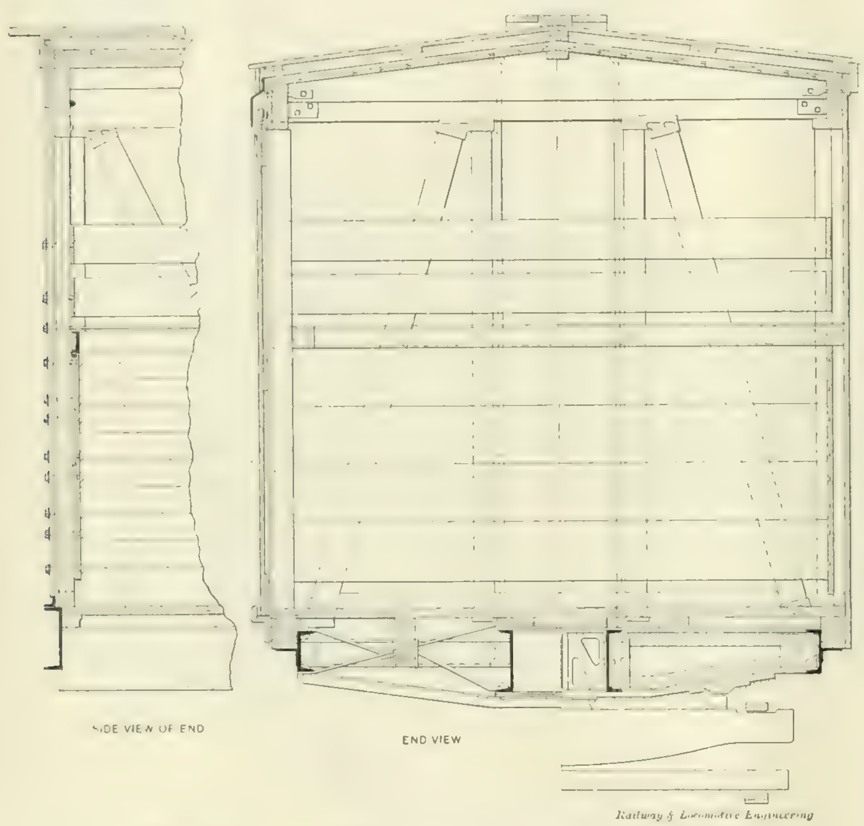
"It is well known that the Portsmouth Railroad has to turn everything to account to pay running expenses, and many are the jokes they perpetrate upon the conductors in reference to their shifts to get a living. It is said that one of them last year was accustomed to bring fish from Portsmouth and peddle them out at the stopping places on the way to Concord. One day he brought along smelts, dealing out to customers at every stations, till he got to Suncook, where he blew his horn, and an old woman came out and wanted six, 'just a pattern —all I've got left, you're in the nick of time,' said he, and he began to count them and found only five. 'How's this? I should have six;' and he began to count his fingers, and reckon over how he had disposed of the four dozen he had started with. After a while, 'I have it; hold on a little while and I'll be back,' said he; and he run the train back seven miles to a place where he let a woman have one more than she paid for, got it, came to Suncook, and let the old woman have the six she wanted, and then the 'smelt' train went to Concord."

When it was first proposed to make passenger cars for the Baltimore & Ohio Railroad with end doors and an aisle in the middle great opposition to the plan was raised in a directors' meeting. The leader of the opposition declared that with passengers sitting at each side the aisle would be converted into a long spittoon. When the other directors reflected enough to realize the prevailing practices of travelers of that day, they decided that their colleague was right, so side doors and cross seats were decided upon.

It is not things, but opinions about the things that trouble mankind. When therefore, we are worried or troubled or grieved, never let us blame any other than ourselves; that is to say, our opinions.—*Epictetus.*

Box Car with Strong End Construction, for the Central Railroad of New Jersey.

In Oliver Wendell Holmes' poem, "The Wonderful One-hoss Shay," it will be remembered that the Deacon pointed out that the trouble with shays in general was that "they always broke down but never wore out." To avoid this breaking down he made every part just as strong as every other part, and it ran a hundred years, to a day. The trouble with railroad equipment is that it more often breaks down before it wears out, and talking of box cars one of the weakest portions of its anatomy is its ends. Many cars with steel underframing and strong sides, and covered with good roofs, are notoriously weak as regards end construction. Through the courtesy of the motive power department of the Central Railroad of New Jersey we are able to place before our readers some information regarding a 60,000-pound capacity box car, with steel underframing, and an end construction of exceptionally strong design.



NEW BOX CAR, CENTRAL RAILROAD OF NEW JERSEY.

It will be noticed from our illustration that the side sills are made of 8-in. steel channels, the center sills are 12-in. channels, and the end sills are also 12-in. steel channels, placed 4 inches higher than the center sills. Close behind the end sill a flat 2½-in. piece of oak extends across the car, and upon this piece rest the malleable pocket castings which receive the bottoms of the end posts. The lower ends of the end and corner posts, therefore, are contained in pockets which are placed 1½ ins. down behind the steel end sill. Each end post is covered on the inside of the car by a 4-in. channel, 5½ lbs. per foot, which is bolted through. The end sheeting of the car is carried down to the top of the steel end sill and is backed by a 1¾x1¾-in. angle, which also stands on the top of the end sill. From this it will be seen that the end posts have at their lower ends, with end sill and angle iron, a depth of backing 3¼ in. deep with which to resist breaking out at the bottom.

In addition to the security of the end posts the belt rail is covered inside the car with 4-in. channel, 5¼ lbs. per foot, which extends across the car. Just below this is a tie rod which goes through from side to side, while just above the belt rail are two tie rods passing through the corner posts and carried back to the first upright side post which stands above the body bolster. Here this longitudinal tie rod is fastened with a strap bolt end. The sheeting inside at ends of car is 1¼ in. thick, and where secured to the end posts a strip of 2x¼ steel is placed outside, and against this the heads of the bolts are drawn.

A feature which is noticeable all over this car is the fact that bolts are used throughout and the nuts are on the outside, where they can be readily seen by the car inspector and easily tightened up when necessary. There are two wide inside sheeting boards run all round the car, above the belt rail level, for additional protection of the outside sheeting against the side play of high loads. These boards are 7½ ins. wide and are spaced 3¾ ins. apart. The vertical tie rods are not set into the edge of the side posts, the rods stand clear so that they may be held with a pair of tongs or pipe wrench, and prevented from turning when the nuts are being tightened up. The roof is stiffened by having an extra course of wood lining which rests upon the carlines, and above this extra course is placed the Excelsior improved inside car roof.

The body bolsters of this car are built up as shown in our illustration, and the needle beams are composed of steel channels and flat braces. The two center sills are covered, for the greater part of their length, by two flat plates riveted to the flanges, so that the draw sills in this case practically become a box girder braced to the outside sills by body bolsters and needle beams. The trucks are of the heavy arch bar type and are supplied with the Barber oscellating device, which permits side motion and insures automatic centering. The wooden portion of the side sills are secured to the 8-in. channel by an angle iron riveted to the steel sill, which receives a series of bolts and holds the timber firmly, to which the side sheeting is attached at its lower end.

Tower couplers are used, Symington journal boxes, and the Williamson & Pries draw gear. The cars are also equipped with the New York air brake.

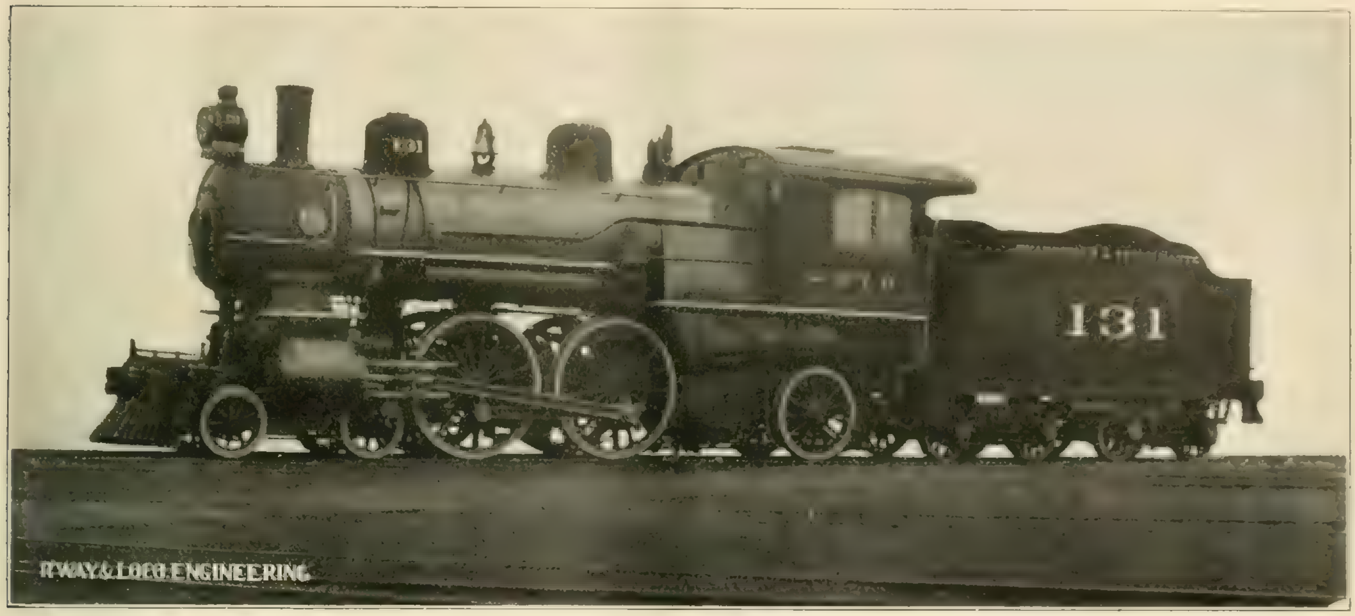
These cars, notwithstanding the reinforced roof, steel underframe and stiffened ends, weigh light about 37,500 lbs. They were built by the American Car and Foundry Company at Berwick, Pa., from designs furnished by the motive power department of the C. R. R. of N. J., of which Mr. Wm. McIntosh is superintendent of motive power and Mr. Geo. W. Wildin is mechanical engineer. The order is for a thousand cars.

Machinists Going to Canada.

A large number of the employees of the Schenectady branch of the American Locomotive Company has left for Montreal, Canada, where they have secured positions with the Montreal Locomotive Works, which has been opened in that city to furnish locomotives for the railroads of the Dominion. Many of the best machinists of the Schenectady works have been secured by the Canadian works, and they have been appointed to positions as foremen at once, with good financial prospects.

The Canadian works have been instituted because of the fact that the Amer-

ican works, on which the Canadian roads dpended for the supplies of engines, are already rushed with orders and are unable to take any new orders. The books of the American Locomotive Company, it is announced, are full for the next year or more, and the orders which have been received from Canadian roads have, in many cases, been returned unfilled. The Canadian Pacific Railroad needs 500 new engines in a hurry. Forty-six have been secured from the American Locomotive Company, a few in Scotland, several more in Germany, and half a dozen from France. The opening of the great transcontinental line through Canada is sure to result in a continued demand for locomotives, so that it has been found to be necessary to start in the manufacture of engines on a large scale, in order to meet the demand.



FAST PASSENGER 4-4-2 ENGINE FOR THE EVANSVILLE & TERRE HAUTE

Evansville & Terre Haute Fast Passenger Engine.

The American Locomotive Company have recently turned out of their Dunkirk shops some 4-4-2 engines for the Evansville & Terre Haute Railroad, a half-tone illustration of which is here shown.

The engine is simple, with 19x26-in. cylinders and 73-in. driving wheels. The total weight of the machine is 150,000 lbs., of which 88,000 lbs. rest upon the drivers. The valve motion is direct, both arms of the rocker being above the pivot point, and the transmission bar passes with a gentle curve over the forward driving axle. The valves are balanced piston. The pedestal binders are made something in the form of a link with a screw at one end. This encloses the base of the pedestals, and with a filling block between the jaws is drawn up tight and clamped.

There are a number of Brooks' details to be seen on this engine, such as the reach rod, made of extra heavy 2-in. pipe; the Player ash pan, the spring hanger joints and the spring self-centering device on the carrying wheels at the rear. The equalizer between rear driver and carrying wheel has three pin holes, any one of which may be used, thus giving a chance for a slight redistribution of weight when engine is in the round house. The engine truck is supplied with the three-pivot link hanger for the cradle, which produces a rapid and sure return to center, though allowing considerable side movement.

The boiler is one of the extension wagon-top variety, with wide fire box. The total heating surface amounts to 2,016 sq. feet, made up as follows: Fire-box, 146 sq. ft.; tubes, 1,870 sq. ft. The grate area is 41½ sq. ft. The tubes are 248 in number and are each about 14 ft. 6 in. long. The taper course is the first, and is 58¼ in. diameter at the smoke-box end.

The tender has a coal capacity of 10 tons and the tank holds 5,000 gallons. A few of the more important dimensions are appended for reference:

General Dimensions—Weight in working order, 150,000 lbs.; weight on drivers, 88,000 lbs., weight engine and tender in working order, 258,000 lbs.; wheel base, driving, 6 ft. 8 in.; wheel base, total, 27 ft. 8 in.; wheel base, total, engine and tender, 51 ft. 5¾ in.

Cylinders—19 x 26 in.; size of steam ports, 2⅛ x 24¼ in.; size of exhaust ports, 50 sq. in.

Valves—Greatest travel, 5½ in.; outside lap, 1 in.; inside lap, 0 in.; lead in full gear, 1/16 in.

Wheels, etc.—Dia. of driving wheels, 73 in.; dia. and length of driving journals, 8½ x 11 in.; dia. and length of main crank pin journals, 5½ x 6 in.; dia. and length of side rod crank pin journals, 6⅝ x 4¼ in.

Boiler—Working pressure, [illegible] lbs.; thickness of plates in barrel and outside of fire box, [illegible] in.; fire box, length, [illegible] in.; fire box, width, [illegible] in.; fire box, depth, front, [illegible] in.; back, [illegible] in.; fire box, water space, front, [illegible]; sides, [illegible]; back, [illegible]; tubes, No. 11 B. W. G.; heating surface, tubes, 1,870 sq. ft.; fire box, 146 sq. ft.; total, [illegible] sq. ft.; grate surface, [illegible] sq. ft.; smoke stack, top above rail, 14 ft. 11 in.

Tender—Weight, empty, [illegible] lbs.

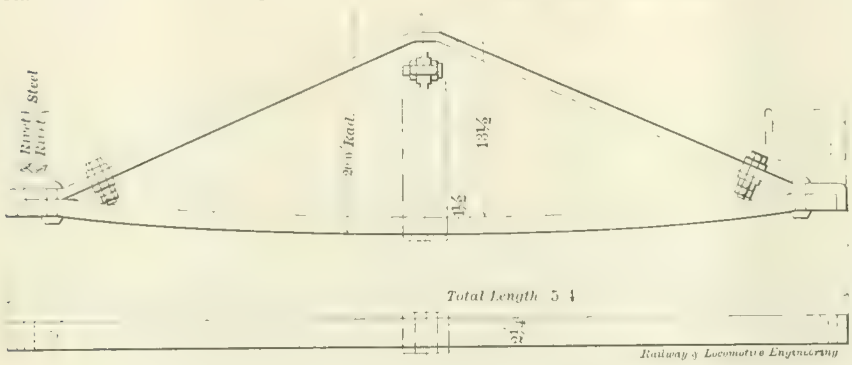
First Sleeping Cars.

Many accounts of the origin of sleeping cars have been published, but the earliest reference to this means of promoting the comfort of passengers is contained in the following article which appeared in the *Baltimore Chronicle*, of October 31, 1838:

"The cars intended for night traveling between this city and Philadelphia and which afford berths for twenty-four passengers in each, have been placed on the road and will be used for the first time to-night. One of these cars has been brought to this city and may be inspected by the public to-day. It is the most complete thing of the kind we have ever seen, and is of beautiful construction. Night traveling on a railroad is, by the introduction of these cars, made as comfortable as that by day, and is relieved of all irksomeness. The enterprise which conceived and constructed the railway between this city and Philadelphia cannot be too highly extolled, and the anxiety of the officers who now have its control in watching over the comforts of the passengers, and the great expense incurred for that object, are worthy of praise, and we are glad to find, receive the approbation of the public. A ride to Philadelphia now, even in the depth of winter, may be made without inconvenience or suffering from the weather. You can get into the cars at the depot at Pratt street, where

is a pleasant fire, and in six hours you are landed at the depot in Philadelphia. If you travel in the night, you go to rest in a pleasant berth, sleep as soundly as in your own bed at home, and on awakening in the morning, find yourself at the end of your journey and in time to take your passage to New York, if you are bent there. Nothing now seems to be wanting to make railway traveling perfect and complete in every convenience, except the introduction of dining cars, and these we are sure will soon be introduced."

The distance from Baltimore to Philadelphia was only about ninety-six miles and did not afford the length of journey that demands sleeping car accommodation. With all the enterprise displayed by the company, and the praise to the scheme accorded by and shown on the part of the public, they did not, however, make it a success, and we are sorry to say that the sleeping cars were so poorly patronized that they were withdrawn after three months' trial.



GRAND TRUNK HIGH SPEED BRAKE BEAM.

Grand Trunk Brake Beam.

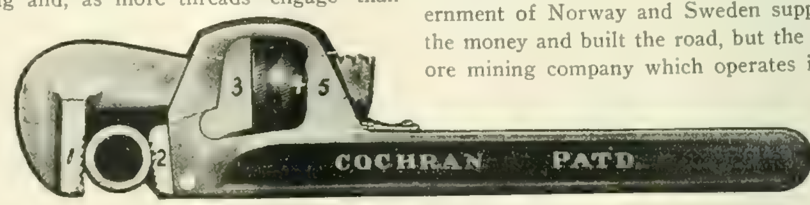
On the Grand Trunk Railway System a very simple and strong passenger high-speed brake beam is being used. It is made out of a bar of wrought iron 2¼ x1¼ in., bent to a twenty-foot radius, thus giving a camber of 1½ in. at the center. This bar, which forms the backbone of the beam, is reinforced by a truss rod of flat iron 2¼x¾ in., which is riveted to the main member at each extremity, and is lipped over the ends.

Between the beam and truss rod is inserted a malleable iron fulcrum through the center of which the brake lever passes at the proper angle. The brake heads are riveted to the beam with ⅝-in. rivets. Two safety hangers are secured to the truss rods by clips, which do not require the boring of holes in the truss rods, and the outer end of the fulcrum has an eye to which is fastened the end of a hanger, which prevents the beam from sagging, so that there is no undue wear on the upper portions of the brake shoes.

The whole beam is really in the form of a cross-bow, with string pulled taut and locked ready for the discharge of the arrow, only in the case of the brake beam the arrow is replaced by the fulcrum, which itself does the locking. In this form any tendency of the bowed beams to straighten under service stresses, tends to tighten the truss rod. This beam has stood up most satisfactorily under severe tests and the Grand Trunk people have reason to be pleased with its simplicity of design, its few parts, its easy construction and its undoubted staying powers when out on the road.

Cochran Pipe Wrench.

The Cochran Pipe Wrench Company, of De Soto, Mo., have got out a pipe wrench that has several novel and interesting features. It is made of crucible and drop forged steel and is therefore practically indestructible. It will not mash the pipe upon which it is placed, as it has a rocker which governs the grip. The outer or hook jaw is made wide at the vital point and its shank is threaded half its length which gives the wrench the required range. The nut is extra long and, as more threads engage than would, in an ordinary nut, it is strong and the wear of the threads is consequently reduced. The price ranges from $2.00 to $6.00, according to size.



THE COCHRAN PIPE WRENCH.

The Arctic Railroad.

The most northerly railroad in the world is the Arctic railroad, in the Scandinavian Peninsula. Its northern terminus is about 130 miles above the boundary of the north frigid zone. The Arctic Circle is an imaginary line drawn about 23½ degrees from the North Pole, and within this circle during the summer the days are long and the nights are short; in fact, at the time of the summer solstice, which is about June 21, the sun does not set at all, and this circle is the boundary of the area where for a certain length of time there is no night.

The railway which penetrates into the "polar regions" has its southern terminus at the Swedish town of Lulea, which is on the Gulf of Bothnia. The northern terminus is Victoria Haven, on the Ofoten fiord in Norway. The road was built for the purpose of marketing the very valuable iron ore which is found in Swedish Lapland. The railway is substantially constructed and its equipment thoroughly modern. In addition to doing a heavy ore business every arrangement has been made to deal with a considerable tourist traffic. A station has been built at the exact point where the railroad crosses the Arctic Circle, and trains will be stopped there for the purpose of letting tourists enjoy themselves, if they so desire, by standing for a few moments with one foot in the temperate zone and one in the frigid, or in doing little eccentric things which people usually do when they cross the equator.

The ore, which is used extensively in Great Britain and Germany, was formerly brought to Lulea, but as the Gulf of Bothnia is frozen over during about half of every year, the transportation of the ore has been very seriously retarded. The opening of the northern terminus, however, has changed all that, and as the Ofoten fiord is deep and is always free from ice, uninterrupted communication can be had with the rest of the world.

The road is in many respects similar to our railways over the Rocky Mountains; tunnels were driven through the mountains which barred the way, and the line, especially on the Swedish side, has to be protected by snow sheds. The government of Norway and Sweden supplied the money and built the road, but the iron ore mining company which operates it, is to pay back the cost of the undertaking and will eventually own the Arctic Railroad.

The first railway in Germany was between Prague and Piken. The work of construction was done mostly by women who were paid twelve cents a day. The road was opened in 1837. There were about two thousand women employed on excavating and in forming embankments. It was said to have been the cheapest constructed railway in the world up to that time, and well it might have been with such cruelly underpaid labor.

Of Personal Interest.

Mr. M. M. Albright has been appointed Trainmaster of the Bluemont Branch of the Southern Railway.

Mr. J. C. Meehan has been appointed assistant master mechanic of the Mobile & Ohio, at Mobile, Ala.

Mr. R. Worrell has been promoted to the position of road foreman of engines on the Kansas City Southern Railway.

Mr. R. E. Simpson has been appointed Trainmaster of the Murphy Branch of the Eastern District of the Southern Railway.

Mr. J. Kirkpatrick has been appointed master mechanic of the Baltimore & Ohio, at New Castle Jct., Pa., vice Mr. H. P. Knight, resigned.

Mr. R. H. L'hommedieu has been appointed general manager of the Michigan Central. He was formerly general superintendent of the road.

Mr. C. D. Shaff has been appointed acting road foreman of engines on the New York Central Railroad, with headquarters at Watertown, N. Y.

Mr. Frank Barr has been appointed third vice-president and general manager of the Boston & Maine Railroad, vice Mr. T. A. MacKinnon, deceased.

Mr. John W. Winn has been appointed general foreman at Richmond, Ind., on the Pennsylvania lines, west of Pittsburgh, vice P. M. Dunn, transferred.

Mr. J. H. Tonge has been appointed chief train despatcher on the Cumberland Valley Railroad, at Chambersburg, Pa., vice Mr. H. A. Logue, promoted.

Mr. J. E. Harlan has been promoted to the position of road foreman of engines on the Illinois Central Railroad, with headquarters at McComb City, Miss.

Mr. L. T. Hutchinson has been appointed superintendent of the car department on the Mobile & Ohio, at Cairo, Ill., vice Mr. James Thornton, resigned.

Mr. A. Harrity has been appointed master mechanic on the Atchison, Topeka & Santa Fe, with headquarters at Ranton, N. M., vice Mr. D. A. Sullier, resigned.

Mr. J. E. Irwin, formerly master mechanic of the Marietta, Columbus & Cleveland Railroad, has been appointed master mechanic of the Little Kanawha Railroad.

Mr. Geo. M. Whinney has been appointed master mechanic on the Great Northern Railroad, with headquarters at Willmar, Minn., vice Mr. G. A. Bruce, transferred.

Mr. H. A. Logue, formerly train master on the Cumberland Valley Railroad, at Chambersburg, Pa., has been promoted to the position of train master on the same road.

Mr. S. B. Hutchinson, assistant general superintendent of the Michigan Central, has been made general superintendent of the road, vice Mr. R. H. L'hommedieu, promoted.

Mr. M. J. Maloney has been appointed road foreman and assistant train master of the Cumberland Valley Railroad, at Chambersburg, Pa., vice Mr. R. M. Moore, transferred.

Mr. W. D. Stratton has been elected president and general manager of the Mobile, Jackson & Kansas City, with headquarters at Mobile Ala., vice Mr. F. B. Merill, resigned.

Mr. Harry Swoyer, formerly general master mechanic of the Louisville & Nashville, has been promoted to the position of assistant superintendent of machinery of the same road.

Mr. W. R. Howden, formerly round house foreman on the Louisville & Nashville, at Anniston, Ala., has accepted the position of master mechanic on the Mobile, Jackson & Kansas City Railroad.

Mr. B. Haskell, formerly superintendent of motive power on the Flint & Pere Marquette, has been appointed general manager of the Franklin Rolling Mills & Foundry Company, Franklin, Pa.

Mr. Henry Giegoldt, formerly master mechanic of the Atchison, Topeka & Santa Fe, at La Junta, Colo., has accepted a similar position with the Colorado & Southern, with headquarters at Trinidad, Colo.

Mr. W. K. Christie, master mechanic on the Pere Marquette, at Saginaw, Mich., has accepted the position of master mechanic of the Lake Erie & Detroit River Railroad, with headquarters at Walkerville, Ont.

Mr. Theodore H. Curtis, formerly mechanical engineer of the Louisville & Nashville, has been appointed superintendent of machinery of that road, vice Pulaski Leeds, deceased. The position of mechanical engineer has been abolished.

Mr. A. G. Elvin, master mechanic on the Delware, Lackawanna & Western Railroad at Scranton, Pa., has resigned, to accept a position with the Coffin-Me[illegible] Supply Company. Mr. [illegible] will be the manager of their mechanical department, with headquarters at Franklin, Pa.

Mr. C. K. Shelby, until recently assistant master mechanic of the Pennsylvania Railroad, at Altoona, has been appointed to the position of assistant superintendent of [illegible] the Philadelphia & Erie division of the Northern Central, vice Mr. J. M. Henry, promoted.

Mr. W. H. Lewis, superintendent of motive power of the Norfolk & Western Railway, was elected president of the American Railway Master Mechanics' Association, at the annual meeting in Saratoga, this year. Last month we inadvertently connected Mr. Lewis' name with the Lehigh Valley.

Mr. E. J. Egan has been appointed transportation inspector on the New York, New Haven & Hartford. The position is newly created and Mr. Egan is the first incumbent. He will investigate the cause of all delays to trains and have general supervision over the movement of equipment.

Mr. Henry Engels, of 91 Fremont street, San Francisco, who represents the Chicago Pneumatic Tool Company on the coast, has lately secured several large orders for pneumatic equipment from a number of western concerns. The orders include a number of Franklin Air Compressors manufactured by the company.

Major Arthur E. Hodgins, superintendent engineer in the construction department of the Central South African Railways, who had been visiting his native land, Canada, on a three months' leave of absence, passed through New York early in August, en route for the Dark Continent, where he will resume his railroad duties.

Mr. W. H. Monroe, round house foreman at Cedar Rapids, Ia., on the Chicago, Rock Island & Pacific, has resigned his position to accept a similar one with the Chicago Great Western, at Dubuque, Ia. The machinists, engineers and firemen on the C., R. I. & P. presented him with a gold watch and chain as a token of esteem and regard.

Mr. W. H. Dunlap, who has been engine house foreman on the old E. T. V. & G. and general foreman on the Southern Railway, has resigned his connection with the road upon which he has been employed for the past fourteen years, and has been appointed general

foreman of the Seaboard Air Line Railway, with headquarters at Atlanta, Ga.

Mr. D. A. Wightman, so well known among railroad men when he was general manager of the Pittsburgh Locomotive Works, is greatly improved in health since he retired from active work. Mr. Wightman was such a strenuous worker that he drew very rapidly upon his reservoir of vital force. He is doing some work for the Baltimore & Ohio people in connection with shop extension.

Mr. W. S. Stone, of Eldon, Ia., has been elected Grand Chief Engineer of the Brotherhood of Locomotive Engineers, to succeed the late lamented P. M. Arthur and A. B. Youngson. Mr. Stone has been in railroad service for the past twenty years, and has been on the Missouri division of the Chicago, Rock Island & Pacific. He has been, for several years, chairman of the General Board of Adjustment of that road. He will fill the position of Grand Chief for the unexpired term of his former chief.

Through depending on information received from a newspaper clipping we had, it appeared by a notice in last month's paper, that Mr. W. J. Hemphill had been appointed superintendent of motive power on the Chicago & Alton Railroad. We have been informed that the report was entirely unfounded. Mr. Hemphill is now general manager of the Evens & Howard Fire Brick Co., of St. Louis, and occupies a more lucrative position than what he would be likely to obtain on a railroad. He has no desire whatever to return to railroad work.

Mr. W. O. Duntley, vice-president and general manager of the Chicago Pneumatic Tool Co., left Chicago recently on a trip to the Pacific coast, in the interest of his concern. His trip will extend over a period of several weeks, as he will endeavor to call on as many as possible of the host of friends and patrons of his company on the coast. He states that business in the pneumatic tool line is in a flourishing condition, and that while the usual depression incident to this season is, of course, somewhat noticeable, still the various plants of the company are yet working increased forces in order to take care of the business already on hand.

Mr. Thomas Plunkett, who has been connected with the Chicago & Alton Railroad for the past thirty years, has resigned from that road to accept the special agency of the Revere Rubber Company of Boston and of the Detroit White Lead Works of Detroit. Mr. Plunkett began his railroad career in the Alton's local freight department, where he remained for five years. He was then transferred to the stationery department, and was stationer for a period of six years. He subsequently became chief clerk in the purchasing agent's office, and acted as dining car superintendent for two years. After this he was given the position of assistant to the purchasing agent, which position he held for nineteen years. He resigned to go into the railway supply business. Mr. Plunkett makes his headquarters at 168 Lake street, Chicago. His friends, who are many, wish him every success.

The Transportation Problem of Greater New York.

Mr. W. W. Wheatly read a very interesting paper at the last regular meeting of the New York Railroad Club. It was on the Transportation Problem of Greater New York. He said that based on the census returns of 1900 it was estimated that the population of New York city at the beginning of this year was 3,437,202 persons. For the week ending Dec. 13, 1902, the average number of persons carried per day on the Manhattan elevated was 749,172 persons and on all the surface lines 1,519,608 persons, making a total of 2,269,229 persons carried every day in the Metropolis.

In giving an outline of the problem to be solved he said, in a recently built 29-story structure there are 1,125 little boxes called offices. Nearly 6,000 people do business in this building. To furnish seating accommodation to the occupants of this one building, to take them home, would require twenty solid trains of six cars each. Notwithstanding the steady expansion of the city, the street facilities remain the same. A twenty or a thirty story city demands more than a one-story street.

The interruptions to traffic are very great in a city like New York. On the surface lines there are a daily average of 24 serious detentions, averaging 18 minutes each. The delays less than 5 minutes are not taken into account, but there are an average of 75 of them every day. On one particular day last winter when a record was taken, at the triangular intersection of Fifth avenue, Broadway and Twenty-third street, there were by actual count 1,910 vehicles which went across the street railway tracks in the hour from 11 A. M. to 12 noon. So great in the aggregate do these obstructions become that surface cars with a possible speed of twenty to twenty-five miles an hour, are practically reduced to a speed of six miles per hour. It may in time become necessary to prohibit heavy trucking on streets like Broadway during the rush hours.

OLD AND NEW INDUSTRIES MEETING.

The speaker dealt with the probable increase in the city's population, and reduced the "problem" to a series of definite propositions. He spoke of the additional facilities already authorized for providing transportation to and from Long Island and the Jersey shore. At present the ferries and the Brooklyn bridge are the only ways travel can pass over the East River. The Manhattan bridge, the Williamsburg bridge, the Blackwell's Island bridge, the municipal rapid transit tunnel, and the Pennsylvania and Long Island Railroad tunnel, will, when completed, have an hourly capacity of 277,800 passengers. On the Jersey side the Pennsylvania Railroad tunnel and the tunnel of the New York &

New Jersey Railroad, together with the municipal rapid transit subway, will have an hourly passenger capacity of 43,000. Other plans are also under consideration.

In discussing the paper Mr. M. N. Forney said the crowding of street cars was the same in New York many years ago as it is to-day. It is the same wherever street car lines exist. The transportation facilities are always just behind the demand. He advocated the doctrine of "A seat on demand, or half fare," as much less unfair to the corporation than the present system is to the passenger.

Mr. Geo. L. Fowler said that years ago he had occasion in New York to take measurements of the speeds and acceleration on every type of motor used in and about the city. He found the best speed which was made on the Hudson County electric road was on the line coming down from Fort Lee on a down grade was 31 miles an hour, while on the road coming out of Coney Island on straight level track across the meadows near Bath Beach was about 21 miles per hour. He said 45 miles an hour was the maximum speed made by express trains on the Manhattan elevated, on the Ninth avenue line on the down grade between Ninety-third and Twenty-third streets, and the uptown expresses were slower. In the matter of acceleration he referred to some experiments made by the General Electric Company at Schenectady, with one of their cars. The Schenectady car attained a speed of 36 miles an hour in 16¼ seconds. The Royal Blue line express running from Jersey City to Philadelphia took 75½ seconds to do the same thing, and the Central Railroad of New Jersey on local trains between Jersey City and Easton took 80½ seconds to get up to a speed of 36 miles an hour.

In the matter of stops, he pointed out that the size of the crowd had everything to do with the time involved. On the Manhattan elevated, with a car two-thirds full, the average stop was 5 seconds. With car full and a few standing it lasted 10 seconds. With car filled to discomfort it rose from 18 to 20 seconds. With cars jammed as are the uptown expresses in the evening rush, the stop lasted from 25 to 30 seconds.

Mr. W. J. A. Boucher quoted from the New York *Times*, and said the elevated trains in New York now maintain a service equal to 165,000 car miles a day, which is approximately equivalent to 400 cars a day between New York and Pittsburgh, say 400 miles, which would require a 5-car train every 9 minutes during the entire 24 hours. The magnitude of the New York "problem" may be appreciated by remembering that this car mileage was made on 110 miles of track and 800,000 were carried daily.

Prof. Wade Hibbard pointed out that the average New Yorker's idea was to save time, not to save his strength. On the surface, elevated and underground lines, he said, New Yorkers were not going to save time by sitting down, so they were content to stand. He advocated side door cars such as were used at the Columbian Exhibition at Chicago in 1893.

Mr. H. H. Vreeland said: If you take the Interstate Commerce Commission's report for last year on the steam railroads of the United States and Canada you will find that they did not move as many passengers during the last fiscal year as were moved on the Island of Manhattan and the Bronx, and you will get some idea of comparison of conditions. In Greater New York last year, over 700,000,000 were carried in the Boroughs of Manhattan and the Bronx, and the whole country only carried something over a billion.

TEN-WHEEL PASSENGER POWER FOR THE GRAND TRUNK SYSTEM

Grand Trunk Ten-Wheel Passenger Engine.

A good example of ten-wheel passenger power built by the Grand Trunk Railway of Canada at their Point St. Charles Shops, Montreal, is here shown. The engine is simple and has cylinders 20x26 in. The outside diameter of the driving wheels is 73 in., and the weight carried by them is 132,608 lbs. The weight of the engine itself in working order is 177,772 lbs., which leaves 130,856 lbs. on the engine truck. The tires of the main driving wheels are without flanges and the side rods are solid-end rods of I-section. With 200 lbs. boiler pressure these engines would be capable of exerting a calculated tractive effort of about 24,200 lbs.

The boiler is of the extended wagon-top type, 62 in. outside diameter at the smoke-box end. The grate area is 33.43 sq. ft., and the total heating surface is 2,460.1 sq. ft., of which 188.1 is in the fire-box and 2,272.0 is in the tubes. The height of the center line of the boiler is 8 ft. 10 in. above rail level, while the top of the smokestack is 15 ft. 1¾ in. above the rail. The smokestack for this class of engine measures 16¼ in. outside diameter, and is 38¾ in. high. It rests on a flanged steel base, which is Grand Trunk standard.

The valve gear is indirect and the valves are of the piston type. Cylinder and valve chamber are placed close together and are neatly enclosed in one casing. The cross-head is of the alligator pattern, and carries an oil cup on the side in addition to the usual guide bar cup. All the drivers are braked and so is the engine truck, the wheels of which are 38 in. in diameter. The driving tires are held in position by shrinkage and a retaining ring is also used on the inside of each wheel.

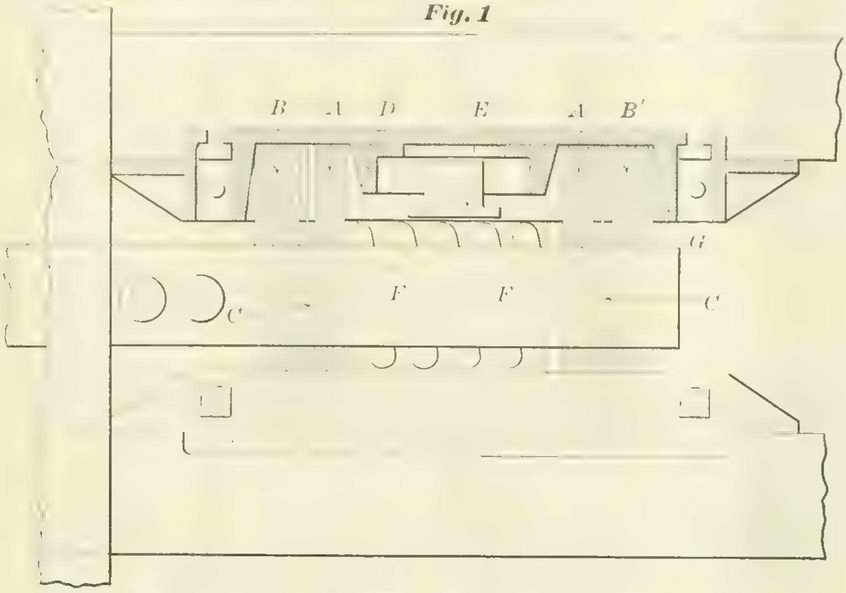
The tender frame is made of steel channels, the outside sills have the flanges turned inward. The water capacity of the tank is 6,000 U. S. gallons and 20,000 lbs. of coal is carried. The tender wheels are 42 in. in diameter, and the weight of the tender is 130,856 lbs. The total weight of engine and tender in working order is 308,628 lbs.

We are indebted to the courtesy of Mr. W. D. Robb, superintendent of motive power of the Grand Trunk System, for the photograph and data which we are able to reproduce for the benefit of our readers. The engine presents the neat and trim appearance which is the result of careful designing and compact grouping of parts.

A New Style of Draw Gear.

The accompanying illustration shows in general the construction and action in service of the Waugh spring draw gear, which is covered by patents recently issued to J. M. Waugh. Fig. 1 shows all parts at rest; Fig. 2 shows auxiliary groups curved in second action.

Fig. 1



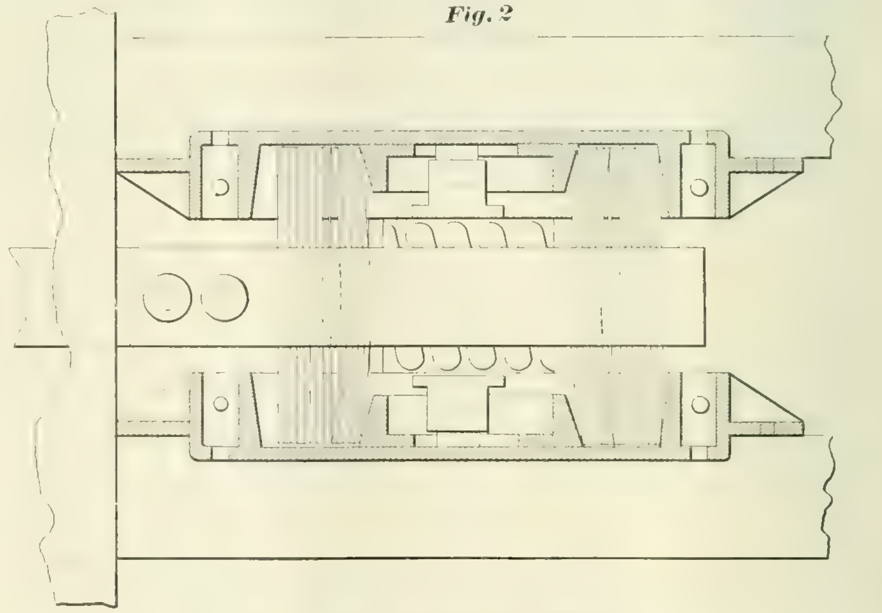
WAUGH DRAW GEAR. ALL PARTS NORMAL.

Fig. 3 shows all spring plates curved when coupler has traveled 2 in. and buffer of coupler is in contact with the headblock.

The construction consists of pocket castings which are of malleable iron or steel. They are recessed in the timbers 1 in. and have flanged projections extending along the inner face of the draw sill and bolted through the timber to prevent the timber from splitting. On the inner face of the pocket casting are two lugs on which slide abutment-blocks D, these are provided with oblong slots corresponding to the lugs to allow the abutment-blocks D to change their position, as the followers travel in either direction. Surmounting the lugs are caps E which hold the abutment-blocks D in position, and also keep the coil spring on the center line. The coil spring used is the standard 8x6¼ in. double coil spring. The plates which compose the followers are all of spring steel 1 in. thick, 6 in. wide and 12 in. long.

Groups A and A1 are auxiliary followers and in the combination and diagram shown, are each composed of 6 straight plates of above dimensions. Group B and B1 are the main followers and are each composed of 8 plates of the same dimensions. F and F are thimbles inserted in either end of the coil spring, the inner ends of the thimbles come in contact ⅛ in. before the coil spring is closed, thus preventing the coil spring from being driven solid. Separating each auxiliary group from the main group is a separating block C which is made up of two parts, one part provided with lugs, and the other with corresponding holes, and between the parts is a steel plate 1-16 in. thick, the length and width being the same as those of the follower plates, but this plate is intended simply to hold the block C in the center. The surface of the block C in contact with the auxiliary group is an oval of ⅝ in. curvature, while the surface in contact with the main group is a ⅜ in. curvature, and are the curvatures taken by the auxiliary and main groups

Fig. 2



COIL SPRING COMPRESSED 1⅝ INS.

of plates when coupler has traveled 2⅛ in. in either direction. In Fig. 1 the ends of the abutment-blocks D are not in contact with the auxiliary groups A and A1 and the opening admits of the coil spring being compressed ⅜ in. before pressure is exerted on the auxiliary groups through the abutment-blocks D.

In service the gear has three distinct grades of cushion. The first is when the coil spring has been compressed ⅜ in.; the backward movement of the auxiliary group A will slide the abutment blocks D until they come in contact with the auxiliary group A1, and in this travel, about 7,000 lbs. of the capacity of the coil spring has been utilized. The second action is shown in Fig. 2. The coil spring has been compressed 1¼ in. more and in this second action each auxiliary group has been curved ⅝ in., but in opposite directions, by the abutment-block D and 83,000 lbs. of the blow has been absorbed on a total travel of 1⅝ in. It will be seen in Figs. 1 and 2 that the bearing shoulders of the pocket for the main followers are not at right angles to the wall of the pocket, but diverge at an angle which will allow the followers B1 to be curved ⅜ in. out of a straight line before taking the angle of the shoulder and in the third action as shown in Fig. 3 the thimbles in the springs are in contact and the pressure is directed along a center line through the thimbles F separating blocks C to the center of the rear followers B1, and when curved to the angle of the shoulders ⅜ in., making a total travel of 2 in., a compression test showed 183,600 lbs.

When the coil spring has been compressed until the abutment-blocks are brought in contact with each auxiliary group A and A1 from that point to the limit of travel of the coupler, the force of the blow is resisted by front and back followers alike and in opposite directions through the abutment-block D, and so long as the coupler travels there is a resiliency in the spring plates and the draw gear or timbers do not receive a solid shock, and with 2⅛ in. travel of the coupler only 1-3 to 2-3 of the elastic limit of the plates has been used. The adhesion of the smooth surfaces of the

steel plates in each group by pressure through the abutment-block to curve them together with the check offered by the abutment-block to their return to a straight position until the coil spring is released prevents the recoil. What has been shown of the action in buffing shocks is true under tensile strains. Tests made with different combinations of the plates show 93,000 lbs., 125,000, 166,000, 183,600 and 218,000 in 2 in. travel.

The device is being used by several railroad and car companies, on high capacity cars, and is giving entire satisfaction. The 125,000 lbs. capacity draw gear has been adopted by some railroads on their passenger equipment. The device is manufactured and sold by the Waugh Draft Gear Co., 1525 Monadnock Block, Chicago.

Rise of Mr. A. C. Bird.

We frequently hear the complaint made that the chances for advancement in the railroad service are almost blocked by the presence of men favored by influence, and that merit and hard work no longer count. That is not true. The chances of promotion by hard-working merit are as good as they ever were, and they never will be beaten where honest work has to be done.

The ambitious railroad man will find a new beacon in the success of Mr. A. C. Bird, who has just been created traffic manager of the Gould Railway System.

After returning from the war in 1865 he began railroad work as a night watchman on the old St. Louis, Alton and Terre Haute Railroad. Then he became a bill clerk in the freight department with work to do which brought his opportunity. He proceeded to master every detail of the business, and the same policy pursued in every position which he reached, kept him moving upwards. He succeeded because he deserved success, as others with similar attributes will do as long as railway business lasts.

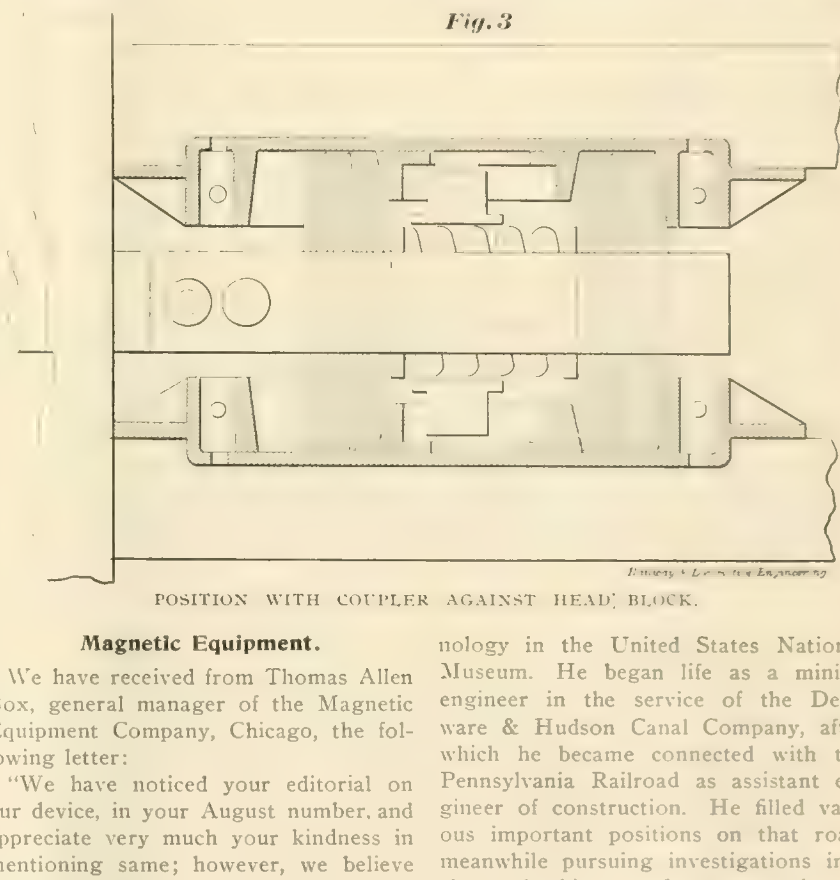
Cost of Steel Rails.

We have repeatedly said that railway companies are charged by the Steel Trust an exorbitant price for steel rails. We suppose from our knowledge of steel making that the steel makers were obtaining a profit of about 100 per cent., but a letter from Mr. Schwab to Mr. Frick, which has been published by the *New York Herald*, indicates that the profit ranges from 130 to 150 per cent. The letter reads:

"As to the future, even on low prices, I am most sanguine. I know positively that England cannot produce pig iron at the actual cost for less than $11.50 per ton, even allowing no profit on raw material, and cannot put pig iron into a rail with their most efficient works for less than $7.50 a ton. This would make rails at net cost to them at $19. We can sell at this price and ship abroad so as to net us $16 at works for foreign business, nearly as good as home business has been. What is true of rails is equally true of other steel products. As a result of this we are going to control the steel business of the world.

"You know we can make rails for less than $12 per ton, leaving a nice margin on foreign business. Besides this, foreign costs are going to increase year by year, because they have not the raw material, while ours is going to decrease. The result of all this is that we will be able to sell our surplus abroad, run our works full all the time, and get the best practise and costs in this way."

Yet an import duty of $8 a ton is imposed to protect these steel makers from the ruinous competition of cheap European labor.



POSITION WITH COUPLER AGAINST HEAD BLOCK.

Magnetic Equipment.

We have received from Thomas Allen Box, general manager of the Magnetic Equipment Company, Chicago, the following letter:

"We have noticed your editorial on our device, in your August number, and appreciate very much your kindness in mentioning same; however, we believe there are some facts in connection with our device you are not fully informed upon; if this is the case, it would afford us great pleasure to give your representatives any information in our possession. We herewith enclose copy of letters from engineer and fireman who have been running our locomotive.

"We do not compare an investment in our company with a Government bond, yet we feel the earning possibilities of our stock is as great as any ever offered on the market.

"Thanking you in advance for courtesies shown our company, and assuring [illegible] information you may desire, we beg to remain," etc.

It may be that the contrivance for increasing adhesion by magnetic attraction may ultimately be made a success, as many other inventions have been developed over the wrecks of repeated failures; but meanwhile, we entreat our readers not to put any of their hard-earned savings into the stock of this company. A new concern which solicits stock subscriptions before thorough practical trials have demonstrated the value of their property, ought to be avoided on general principles.—Ed.

Obituary.

The engineering world has suffered a severe loss in the recent death of Dr. John Elfreth Watkins, who for many years was curator of mechanical technology in the United States National Museum. He began life as a mining engineer in the service of the Delaware & Hudson Canal Company, after which he became connected with the Pennsylvania Railroad as assistant engineer of construction. He filled various important positions on that road, meanwhile pursuing investigations into the early history of transportation in the United States. In 1884 he became honorary curator of transportation in the National Museum in Washington, and at once began to develop that part of the museum's collections which are now so valuable. He subsequently severed his connection with the Pennsylvania and became curator permanently. He was called upon to assume the directorship of the Department of Industrial Arts in the Field Columbian Museum in Chicago, when that institution was opened, but returned again to the National Museum after a year. He

published numerous papers on the history of transportation, among which may be mentioned, the "Beginnings of Engineering," in 1888; "The Development of the American Rail and Track," in 1889; "The Log of the Savannah," in 1890; "Transportation and Lifting of Heavy Bodies by the Ancients," in 1898, and also the "History of the Pennsylvania from 1845 to 1896."

A. B. Youngson, assistant grand chief engineer of the Brotherhood of Locomotive Engineers, who, upon the death of the late P. M. Arthur, became grand chief of the order, died suddenly at Meadville, Pa., July 29.

Rumors of N. Y. Central Discharging Engineers.

The discharge, within the last month, of over twenty locomotive engineers belonging to the New York Central, most of them advanced in years, has led to rumors that the company was systematically dropping its old men.

A *Press-Knickerbocker-Express* reporter talked with a number of Central engineers regarding the reports in circulation. "I am aware that a number of engineers have been discharged of late," said one, "but that is likely to occur at any time. The fact is the company is becoming stricter every day, especially as regards the indulging of their engineers in intoxicating drinks."

It is said that the engineers are constantly being shadowed by spotters in the shape of unpretentious young men who would be taken for the sons of farmers rather than city bred youths. On duty or off duty the engineer is under surveillance, and when he visits a saloon he is immediately reported to headquarters, with the result that he is shown no mercy.

Track Train Stopper.

An item has been sent out from Washington as a notice contributed by the United States Consul at Leipsic, that the invention of putting appliances in the track to stop locomotives when danger is ahead has been patented in the United States probably fifty times. It seems, however, to be new to Germany.

"A meeting of the commission composed of representatives of the Imperial, Prussian, Bavarian, Saxon and Baden State railroads was held at Karlsruhe on July 9 in order to test a new brake, which is known as the Steiner distance brake.

"This new invention may be said to be an improvement upon the air brakes now in use. It is so connected with the air brakes of a train that when the front wheels of a locomotive pass over a danger or halt signal placed upon the tracks it will automatically put on the brakes at the same time opening the whistle valve.

"The apparatus worked satisfactorily even at the great speed of 83.75 miles an hour, but because of the extraordinary strain to which it was subjected an important part thereof was broken.

"The commission has recommended that an extended trial be given to the Steiner brakes upon the regular train service."

Blacklisting Not Unlawful.

We have always understood that the "blacklisting" of discharged employees was a crime before the law, and one of the meanest actions that an employer of labor could be guilty of; but the United States Circuit Court has just rendered a decision that the miserable practice is lawful. The man who "begs a brother of the earth to give him leave to toil" may legally have his plaint denied because some other brother has secretly put a knife into his character.

The Commercial Telegraphers' Union applied to the Circuit Court of the United States for an injunction preventing the Western Union Company from discharging employees because they belonged to the union and from maintaining what is known as a blacklist of such discharged employees.

The complaint alleged, first, that men had been dismissed without notice from the company's employ because they were members of the union, and, secondly, that the Western Union, its officers and its agents had entered into a conspiracy to destroy the union.

The application for an injunction was denied, and Judge Rogers in the decision held that in the absence of contract relations the employer has the same right to discharge any employee, with or without notice, as the employee has, under the same conditions, to quit the service of the company.

In regard to the charge of conspiracy to destroy the union by discharging members thereof, the Federal Judge's opinion was that the dismissals were lawful and that there could be no conspiracy in doing a lawful thing.

N. & W. Building 500 Cars.

To meet the constantly increasing growth of its coal traffic, the Norfolk and Western Railway has announced that it will build 500 new cars at its own shops, for fall delivery. The cars will have a carrying capacity of 100,000 pounds and will have under frames of steel. Double I-beams, bolsters and truck frames of the barber type will be used, with cast steel center places. The bottom will be constructed of copper. The additional rolling stock will represent an outlay of about $500,000.

Norfolk is one of the greatest coal distributing ports on the Atlantic coast, and the trade is rapidly increasing in volume every year. The Norfolk and Western has announced that it will continue to haul cars as the conditions justify. The 500 new cars will be ready for service when the fall activity in shipping begins.

Tests of speed with the new Mail Train No. 43 on the Lake Shore & Michigan Southern were made between Toledo and Cleveland the other day. Engine 651, with Engineer Charles Parish, covered 108 miles in 110 minutes. Eleven minutes were consumed on the first six miles due to an arbitrary grade. The 102 miles following were covered in 99 minutes. This included five slow-downs and a loss of 5 minutes at Sandusky, which brings the actual time consumed for the 102 miles, with 5 mail cars, down to 94 minutes.

M. C. B. Report on Cast Iron Wheels.

The M. C. B. committee on cast iron wheels made some interesting observations in their report to the Association on the design, weight and material for cast iron wheels for cars of 60,000, 80,000 and 100,000 pounds. In answer to a circular which was sent out by the committee to all members of the Association and to prominent wheel makers, there were submitted to the committee some twenty different designs of wheels for the three capacities of cars, given above, which designs were giving satisfactory results in actual service.

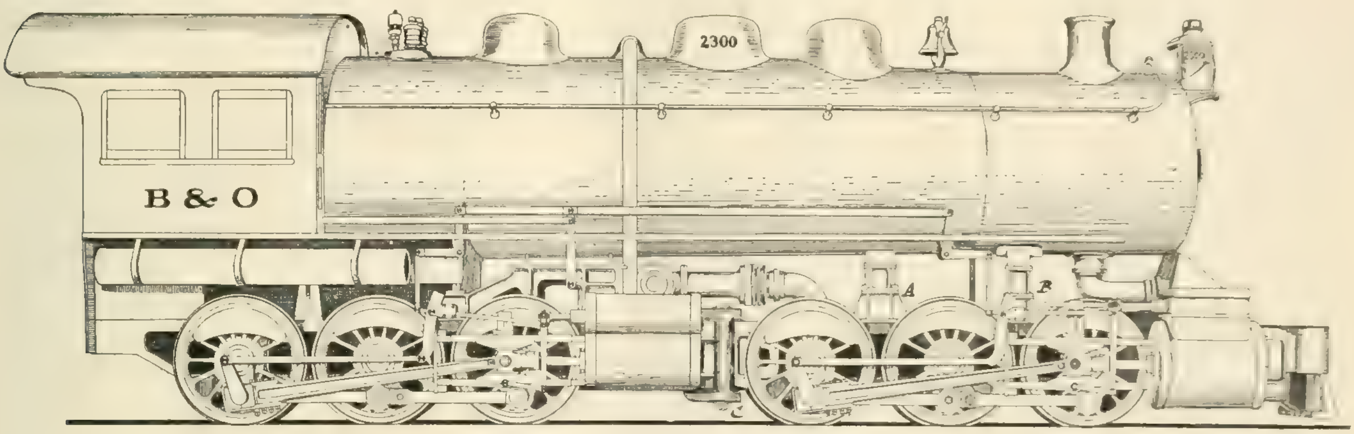
The committee had each of these wheel drawings made full size on cardboard and cut out. The committee then made a composite wheel drawing by grouping all those designs where the contours of the plates were fairly alike were placed one over the other, and a composite drawing was made, these composite drawings were again plotted and a final composite drawing was made for three wheels, suitable each to the three capacities of 60,000, 80,000 and 100,000 pounds. The committee regards these "evolved" designs as giving a very handsome wheel and thinks that though they may not be any better than any of the designs from which they were made, yet the committee were of opinion that the designs of these representative wheels which they thus worked out, would be at least equal to the best design now in use, and one safe to be followed in making new patterns. This original method of producing one wheel from many designs reminds us of the definition sometimes given of a proverb. A proverb is said to be "the wisdom of many and the wit of one." These wheel designs are the result of experience on many roads and the composite design is due to the skill of one committee.

A form of wheel design was submitted by one manufacturing concern which is intended for wheels of 100,000-lb. cars.

It is a double plate wheel, but the outside and inside plates run separately from hub to rim, and so include a large core space. Sixteen ribs on the inside plate are introduced into the core space, and both plates are curved slightly outward on lines which are at once easy and graceful. The committee, while submitting this design to the Association along with the other composite ones, makes no comment on the maker's design on account of having no data concerning its behavior in service.

Baltimore & Ohio Articulated Locomotive.

The huge locomotive here illustrated is under construction for the Baltimore & Ohio Railroad, and will be considerably heavier than any other locomotive ever built. This engine will be built as an experiment and will be used as a helping engine on mountain grades to demonstrate its usefulness. If found satisfactory it will be sent to the St. Louis Exhibition.



A MONSTER LOCOMOTIVE.

The engine is of the Mallet articulated type, which has been used very successfully in France and Switzerland for many years. Small specimens of the Mallet type of compound locomotives were used in the grounds of the last two Paris expositions, and they were reported to be highly efficient. We think the type is particularly well adapted to mountain service in any country and we have been surprised that it was not introduced into this country before. The Baltimore & Ohio was the first railroad company in the world to introduce the use of freight locomotives weighing more than twenty tons, and it is quite fitting that they should take the lead in introducing a practical freight engine weighing over one hundred tons.

This locomotive really consists of two engines with power transmitting mechanism for each. They are compound; the forward cylinders being H. P. and the back pair L. P. The front cylinders with their saddle and the wheels can move radially under the boiler with radial point at C. The boiler slides on supports at A and B, and a joint has to be made in the steam pipe.

The leading dimensions of this tremendous engine are:

Weight in working order, [illegible] lbs.; rigid wheel base, 10 ft.; total, 30.5 ft.

Cylinders [illegible] and 20 x 32 in.; wheels [illegible] in. dia.

Balanced slide valves.

Boiler, wagon top 76 ins. dia.; firebox [illegible] ins. long, [illegible] ins. wide; tubes, [illegible] 2¼ ins. dia.

Heating surface of tubes, 4,[illegible] sq. ft.; heating surface of firebox, 190 sq. ft.; grate sur., [illegible] sq. ft.

Ratio—Heating surface to grate surface, 77.1; heating surface to cylinder volume, .0068; tractive power, 63,800 pounds; heating surface to tractive power, 15.43; tractive power to weight on drivers, 4.46.

Saving from High Pressure Steam.

The tendency of locomotive designing keeps toward increasing the boiler pressure, and it is difficult to tell when a limit will be reached. I was giving a talk a short time ago on the progress of locomotive engineering to a meeting of railroad men and after the meeting was over several of them expressed the belief, very freely that locomotives carrying steam of 140 pounds gauge pressure did their work just as economically as engines do that are now carrying 200 pounds gauge pressure. I find that this opinion is held by many practical railroad men. As it is difficult to show by experiment the saving effected by the higher pressure owing to the difficulty of getting people to undertake exhaustive shop tests I shall show by calculation that there is economy in using high pressure steam.

The mechanical theory of heat is admitted to be correct and its teaching has brought about very great improvements in the steam engine. Authorities on the mechanical theory of heat gives the efficiency of a perfect engine as $E = \frac{T - T}{T}$ where T represents the absolute temperature of the steam before doing work and T, after it is ready to pass through the exhaust. Absolute temperature means reckoning from the point where there are supposed to be no heat vibrations. Experiments have located this point at 460° Fah. below zero, so to reduce to absolute temperature, add this figure to the readings of a common thermometer.

The temperature of steam at 200 pounds is 388° and at 140 pounds boiler pressure 361° and at 5 pounds 228°. Reducing to absolute temperatures and substituting in the above formula we have for engines using steam at 200 pounds

$$E = \frac{848-688}{848} = 0.1886$$

For engines using steam at 140 pounds

$$E = \frac{821-688}{821} = 0.1620$$

Difference in favor of 200 pounds, .0266 or 2⅔ per cent.

That is not a great saving for people who are always looking for at least 25 per cent. saving for any improvement, but it counts up on an engine when the whole of the monthly fuel bill is considered.

ALBERT CONVETH.

New Haven, Conn.

Kerosene Leakage.

While it is true that kerosene is of a penetrating nature, and that it will leak through a very narrow crack, it is also the case that water is nearly, if not quite, as penetrating. One reason why a leakage of water through a narrow crack is not so apparent as that of kerosene is that it evaporates and leaves little or no trace of the leak. Again, if there is any sediment or suspended mineral matter carried by the water, the evaporation soon leaves a deposit that effectually seals the crack and prevents further leakage. In the case of kerosene the leakage does not evaporate, or does so very slowly, and spreads over the outside of the vessel, making its presence very apparent, whereas the total leakage may be quite small. With the oil there is no tendency for a leak to seal itself, but, on the contrary, kerosene is of a highly solvent nature, and tends to remove all deposits clogging the crack.—*National Oil Reporter.*

Railway Matters in India.

British India appears to be suffering from evils connected with its railway system, which have been paralleled in the United States in the construction of canals. The work has fallen into the hands of people who do not require to make the enterprises pay, and the taxpayers who have to provide the capital sometimes receive less remuneration in utility and convenience than justice and fair dealing demands. There are about 30,000 miles of railway in India which is not very great for a territory of 1,458,000 square miles, with about three hundred million inhabitants; but the conditions of life are so peculiar there that one of the most influential newspapers in Bombay recently made the assertion that it is a highly problematical question whether India would not actually have been better off without a railway than she is to-day with a system which has no parallel outside of Europe. The writer of that remark holds, that those who glory in the lengthening railway mileage mistake exhaustion for progress, and sacrifice profit-producing irrigation to the profitless railway development.

Judging from the tone of the railway press of India, to which we devote considerable attention, we conclude that Indian railways are suffering from a species of, "not how to do it" bureaucracy. They are too much dominated by officials whose principal ability lies in the line of drawing large salaries. Too great a percentage of the earnings of Indian railways has been devoted to paying ornamental officials, while the men who perform the real work are underpaid.

The discontentment which has long prevailed about the unsatisfactory management of the railways of India for many years, moved the Government of India to appoint Mr. Thomas Robertson, C. V. O., whatever that may mean, a special commissioner to inquire into the working of the Indian railway system, and his report was published a few months ago. The commissioner appears to have done the work thoroughly, and his recommendations would no doubt effect desirable remedies if they were only carried out.

The commissioner is very positive in his condemnation of the administrative machinery in existence, and the practical effect of his finding is that railway administration is antiquated, ineffective, wasteful, cramped, wanting in expert knowledge and generally confused. His chief recommendation for remedy is drastic, but on the face of it apparently sound. He says the existing system, so far as general revision by Government is concerned, should be swept away, and that in its place should be appointed a board of experts with home training. The last point is insisted upon, not because suitable men are not available in India, but because in the initial stage, and while the department is being put into proper working order, they should be free from local prejudices and traditions. The operations of this board, to be successful, should be excluded from the general administration of Government, and, unless they are so excluded and the board is allowed to manage the railways entirely on commercial lines, the success they should achieve cannot possibly be secured. Subject to the control of the Governor-General in Council, the board should otherwise be left entirely free to administer the railways, and they should be judged by results.

"It is very desirable," he says, "that the principal officer, that is, the agent or manager, on each railway should have had special training in the working of traffic. It is difficult otherwise for him to deal efficiently with the many questions which must come before him in connection with the chief business of the railway. At present this appears to be the last qualification required of an agent or manager. Senior officers on every railway should be sent home at the expense of their employers at regular intervals to study improvements made since their last visit, so as to keep themselves abreast of the times in their railway knowledge."

We certainly think that the fundamental principle of good railway management is, that the principal officer should know his business, although that does not seem to have always been a requirement in India; but we doubt the value of having them drawn exclusively from Britain or that they should keep abreast of the times of railway knowledge as it is found in Great Britain. British railway management of Canadian railways inclines us to think that Indian railway officials would profit more by keeping in touch with railroad operating in the United States, for the conditions are much more in unison. If the railway officials in India make a systematic study of the American railroad press they will not miss the introduction of many improvements that would be helpful in their business.

The following criticisms and recommendations of the commissioner sound like what a good American railroad manager would make:

"The average speed of trains is not as high as might be expected in a country which has had the benefit of railway communication for nearly fifty years. The speed of the fastest trains ranges from 22 to 30 miles an hour, and that of slow passenger trains from 7 to 17 miles an hour. This cannot be justified by the poverty of the traffic, because the average number of passengers per train is greater in India than in any other country in the world. It is partly due to the actual working speed and partly to dilatory arrangements for watering engines and for performing station duties at stoppage places. A very material acceleration of speed is necessary for the purpose of cultivation of traffic, and the existing staff is quite capable of working the trains at a much higher speed with safety.

"On the principal main lines there should be not less than two fast through passenger trains each way per day, and on every other line not less than two ordinary trains. Dining cars should be provided on all fast through services to economize time.

"Railways in India are insufficiently appreciative of the value of their third class passengers traffic. The less paying first and second class traffic appears to receive all the attention, whereas the traffic which really needs to be fostered is that represented by the third class passengers, who are the backbone of the passenger business of every railway in India. Overcrowding should be avoided. The system of conveying pilgrims in cattle trucks also points to the same absence of proper facilities. Generally speaking the amount of stock provided on trains for third class passengers is inadequate; moreover, third class passengers are subjected to gross incivility, annoyance, abuse, extortion, and even personal violence by the subordinate station staff, and by the police. This is a matter which calls for very special attention.

"Electric lighting and electric fans should be introduced and made compulsory within a fixed number of years, say, five.

"Goods traffic should be greatly quickened. The present speed ranges from three to seven miles an hour. This intolerable state of things is due largely to want of a proper system of running goods traffic, and the whole arrangements need complete revision, on drastic lines indicated in the report.

"Fares and rates are too high. Judged from the standpoint of actual money payment made they are considerably lower than in England, but taking the cost of construction and working of railways in the two countries the fares and rates in India should be only about one-sixth those charged in England, whereas this rate is greatly exceeded. The reduction should be made for passengers by 18 to 40 per cent., for merchandise by 30 to 60 per cent., and for coal by 40 to 60 per cent. These large reductions could not be made straight away, but considerable reductions are immediately possible."

People accustomed from infancy to lie on down feathers, have no idea how hard a paving stone is without trying it.

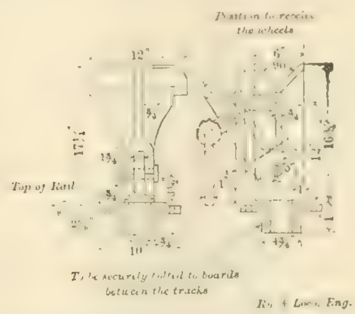
—*Hard Times.*

High Smoke Box Temperature.

A mechanical engineer of a western railroad is reported to have made the following statement to a reporter

"We find that our 19x24 inch 10-wheel engines with 1,700 square feet of heating surface and 30 square feet of grate area are very limited in the capacity to get freight up a long, heavy grade. They are not lacking in cylinder power, but in the ability to make steam. The incapacity of the boiler is further indicated by the fact that the gases escape from the smoke box at a temperature of 1,200 degrees and over, while our recent engines discharge their smoke box gases at only 600 degrees."

If the interview was a real one, the mechanical engineer must have been badly off concerning smoke box temperatures. A temperature of 1,200 degrees would keep the smoke box red hot and is higher than the temperature of fire boxes when the engine is working hard.



HANDY RIG FOR TURNING WHEELS

Handy Wheel Press Jack.

A handy jack for turning mounted car wheels is to be seen in the Ottawa shops of the Canada Atlantic Railway. It consists, as may be seen in the illustration, of a short upright casting or piller which has a wide V-shaped top into which the axle to be turned, fits. The upright casting is made to rock on an intermediate one, but it is provided with a lip so that the rocking can only take place in one direction. This intermediate casting is pivoted into a circular base so that it can be turned about in any horizontal direction.

When the jack is ready for use it stands leaning over at a slight angle, supported by the strut which hangs from the small eye-piece which is bolted to one of the central ribs, and as the pair of wheels come along the track the center of the axle just passes over the side of the inclined V, and strikes the other. The momentum of the rolling wheels carries the jack to the upright position, and at the same time it lifts the wheels from the rails. The operator is then able to swing them wherever required and with a slight push, tilt the jack, which discharges its load with sufficient momentum to bring them up to the wheel press, or run them down the shop track for storage or use.

Something for Their Money.

Some years ago a railway was being made in the neighborhood of Galashiels, and it was arranged that each of the numerous navvies employed should pay one penny per week to a medical practitioner, so that they might have his services in the event of accident or medicine in the case of illness.

During the summer and autumn neither illness nor accident occurred.

But when a severe winter followed, all at once the "navigators" began to call on the doctor for castor oil.

Each brought his bottle, into which an ounce was poured, until the oil was exhausted, and the doctor was forced to send to Edinburgh for a further supply.

When that, too, was getting done, the doctor one day quietly asked a decent-looking fellow what was wrong with the men that they required so much castor oil.

"Nothing wrong at all, doctor," he replied, "but we grease our boots with it."

The Car Shortage.

Despite the fact that the Pennsylvania Railroad now has 213,000 freight cars, 31,000 more than in 1901, there is a car shortage on the road and its branches. The situation is so threatening that General Manager W. W. Atterbury has issued an appeal to consignees asking their co-operation to prevent such a catastrophe. From a ready movement of freight on all divisions of the Pennsylvania Railroad it is evident that the shortage is not due to traffic but solely to delay in relieving cars at destination points. Grain is often held in the West to await more favorable market conditions. Suddenly this bulk is rushed to the eastern ports in such manner as to make it impossible to unload the cars, thus tying them up in loaded trains. This condition is affecting all the larger lines. The same is true of other commodities, especially coal at the lake ports.

The Ear Racking Flat Wheels.

The flat car wheel is greatly in evidence on street cars. That its ear racking noise has been endured so long without murmurs that would rival the noise made by the wheels is adequate testimony for the patient long suffering of the American citizen. Brooklyn, N. Y., appears to have been the first community to lose patience. A petition signed by fifty-nine petitioners, residents of Prospect Park West, has been received at the Health Department, complaining that the flat wheel cars which are now operated on that street make sleep almost impossible, and that invalids and others are seriously affected by the constant thumping of cars, and ask that the Department of Health take action in the matter.

The Board of Health has declared the running of flat wheel cars a public nuisance, and the matter is now in the hands of the Corporation Counsel. An arrest has been made and the matter is now before the Court of Special Sessions.

The Mexican Great Eastern Railway, now under construction, will, when completed, connect the city of Mexico with its port, the town of Coatzacoa, on the Gulf of Mexico. The road will be about 400 miles long and lies amid mountainous country. Mr. Walter G. Seaver, vice-president and general manager of the road, was recently in New York and has placed orders with the American Locomotive Company for ten passenger engines, twenty freight, and four switch engines. The passenger engines are of the 4-6-2 type, simple, with 21x26 in. cylinders, 62 in. drivers and a total weight of about 180,000 lbs. The freight engines are 2-8-0, simple, with cylinders 22x26 ins., 56 in. drivers and weight in all about 200,000 lbs. The special equipment consists of Armspear classification signal lamps, Snow rerailing device and the Handy Coupler on pilots.

The Pennsylvania Railroad Company are building at Altoona a steel passenger coach to be used in the tunnels of New York. The experience in building the car has suggested quite a number of improvements, which will be carried out in the other cars to be built. It is 50 feet long, vestibuled, and has no steps, they being unnecessary, owing to the depressed tracks. The car is equipped with Westinghouse air brakes, and is heated with steam and lighted by electric generators. The seats are of rattan. The car is an experimental one, and is made on plans that will allow its use in interchangeable traffic with the interborough lines of Greater New York.

Joseph T. Ryerson & Son, of Chicago, makers of steel structural shapes, etc., have just got out a desk inkstand of unique design, which they are sending to their friends. The inkwell itself represents a pile of circular stamped shapes, such as cylinder covers, with half a chain link on top, and this inkwell stands upon a number of steel boiler plates and a couple of piles of steel and galvanized iron plates, and between these piles a number of Ts, angles, I-beams, Z-bars, channels, square and round iron, are placed, and on top are two kegs of nails, which in the model are arranged one as a pen wiper and the other as a small pin cushion. A pile of tubes and a pair of miniature forgings make a very ingenious pen rack. This is a very useful as well as a striking desk ornament.

We frequently notice articles in automobile papers telling about certain diseases that have developed on people riding automobiles at high speed, indicating that a pace out of the ordinary gait is dangerous to health. We do not think this is proved in the case of locomotive engineers who are jarred very considerably more than automobile riders, and are among the healthiest class of the community. Among our newspaper clippings received in one day we find an account of one locomotive engineer still in good health who had run a locomotive for 51 years, another in a similar condition who had run 53 years, and one veteran who had begun running four years after the Baltimore & Ohio Railroad was opened, is still living in a green old age. The name of the latter veteran is Mr. Christian Smith, now living at Harper's Ferry.

It is wonderful the vitality of some false statements. An item has been going the rounds of the press for six months that there are 500,000 locomotives in this country, and almost every day we receive the item dished up in a new form, frequently with comments on the aggregate power of such an army of locomotives. One cipher too much is used and 50,000 is about the correct number.

The *Associated Press Reporter* of Baltimore appears to have got hold of a story about an immense locomotive about to be built for the Baltimore & Ohio Railroad to weigh over 150 tons, and the story is going all over the country. We understand that that company contemplate having some unusually heavy locomotives built, but the story of the *Reporter* is an extreme exaggeration.

The Wabash Railroad are experimenting with a locomotive having what is known as the Haberkorn valve motion. We learn from one of the master mechanics that the engine is doing very good work, but they are not prepared to say anything definite about it at present.

We have received a neatly bound volume of the Official Proceedings of the Western Railway Club for the club year 1902-1903. The book is, of course, standard size, bound in cloth, with an alphabetical index at the back. It contains a number of useful and instructive papers on live topics.

Owing to labor troubles among their workmen at Springfield, Mass., the Boston & Albany people have decided to remove the mechanical headquarters of the road to Worcester.

We have just finished our new Book of Books. Every man likely to buy a book for self help ought to keep a copy handy for reference.

The Trans-Siberian Railway.

Traveling on the new Trans-Siberian Railway, from all accounts does not appear to be by any means the uncomfortable journey which many persons thought it would be. Every Monday, Wednesday and Saturday the Tri-Weekly Trans-Siberian Express is run by the Compagnie Internationale, on other days the Russian State Railway runs its trains. The express train consists of one first-class coach, which holds eighteen persons, and in addition there are seven small compartments, each holding two persons, and one compartment for four persons, thus giving accommodation for thirty-six in all. Two second-class coaches holding in the body, twenty-six persons, three compartments in each car, hold two people, with five compartments for four people, making the total second-class accommodation sufficient for fifty-two in each coach. There is also a restaurant car with smoking saloon, and also a car called a "fourgon," which has a bathroom, lavatories, provision compartment and an installation of electric light machinery.

At the present time part of the main line round the southern end of Lake Baikal, near Irkutsk, is under construction, and the traveler is now compelled to cross the lake, train and all, on a huge ice-breaking ferry. The time occupied in crossing is usually about four hours.

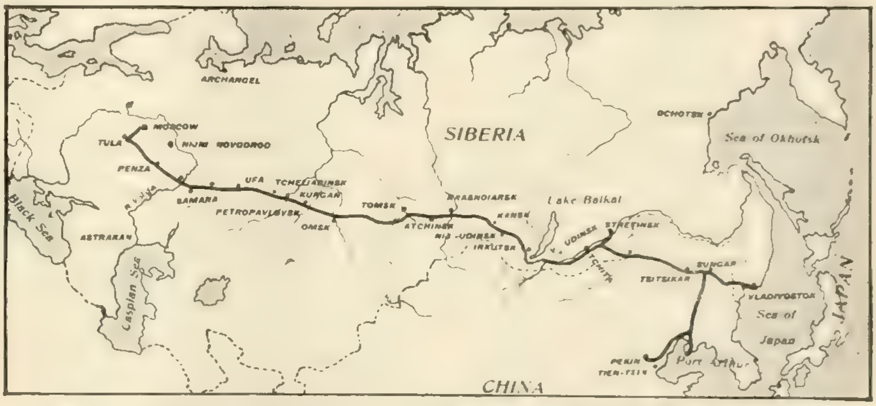
Mr. John Foster Fraser has recently published his impressions of a trip from Moscow to Vladivostock and back, in book form. He has called his work "The Real Siberia." Speaking of the journey, among other things, he says:

"The train was luxuriously fitted, and first-class passengers (there not being many) had each a couple of seats to themselves, double-windowed to keep out the cold, hot-air pipes in plenty, and a thermometer on the wall so that they might see the temperature; a writing table, a chair, a movable electric lamp with green shade, two electric bells, one to the car attendant and the other in communication with the restaurant.

"Each night the attendant would make up a comfortable bed, soft and clean, and the regulation is that the linen be changed three times in the eight days. A touch of the bell in the early morning, and a boy brought a cup of tea. Ten minutes later there was a rap at the door, and the attendant entering, put down your boots he had polished and told you the bath was ready.

"As the rails are wide, the coaches heavy, and the speed something under thirty miles an hour, there was none of that side-jerking which is so inconvenient on an English line. The train ran smoothly, with only a low dull thud to remind you that you were traveling. So steady was the going that I shaved every morning without a disaster.

"Returning to my coupé, I found the bed removed, the place swept and aired, and the attendant spraying the corridor with perfume."



MAP OF THE TRANS-SIBERIAN RAILWAY—MOSCOW TO PORT ARTHUR
Reproduced from The Car.

Study and Profit.

In Charles Dickens' instructive and interesting story called *Little Dorrit,* there occurs these words, which might almost make a text for a sermon: "Study, and profit by all that lies beyond it, like a practical man." We have no intention of writing a sermon, but we may here remark that the quotation given above contains an excellent piece of advice. Study; that is an essential, if any man or boy would succeed in his life's work. Studying is really drinking in the concentrated experience of others. At the present time the reading of books is the most usual way of getting hold of the thoughts of those who have worked before us, but there is another matter besides mere study to which Dickens draws attention, it is to profit by all that lies beyond study. Now the thing which lies beyond study is the assimilating of what has been taken in. It is like digesting the food which has been eaten. To profit by that which lies beyond study, one must call into play the

faculty of reflection. It is no great use to merely know the answer to a question on locomotive firing or running or some such subject and at the same time not to know why the answer is right, or how to apply the knowledge to circumstances slightly different from those under which the answer was learned. Study, the taking in of facts, is the first process. Reflection, or the understanding of the facts, the examining of the facts, the turning of them over and over, talking about them, this is the second process and this is being able to profit by all that lies beyond study. The great writer and portrayer of human lives, says to do this "like a practical man."

In order to assist in study and in the enjoyment and profit of that which lies beyond it we invite you to cast your eye over a few of the books which we recommend to our friends:

The first on the list is, of course, RAILWAY AND LOCOMOTIVE ENGINEERING, a practical journal of railway motive power and rolling stock. It costs only $2.00 a year, and is well worth the money, and besides the paper is a welcome visitor in every household. Let your wife and boys see it.

"Locomotive Engine Running and Management," by Angus Sinclair, is an old and universal favorite. A well-known general manager remarked in a meeting of railroad men lately, "I attribute much of my success in life to the inspiration of that book. It was my pocket companion for years." We sell it for $2.00.

"Practical Shop Talks." Colvin. This is a very helpful book combining instruction with amusement. It is a particularly useful book to the young mechanic. It has a stimulating effect in inducing him to study his business. Price, 50 cents.

"Examination Questions for Promotion." Thompson. This book is used by many master mechanics and traveling engineers in the examination of firemen for promotion and of engineers likely to be hired. It contains in small compass a large amount of information about the locomotive. Convenient pocket size. We cordially recommend this book. The price is 75 cents.

"Compound Locomotives." Colvin. This book instructs a man so that he will understand the construction and operation of a compound locomotive as well as he now understands a simple engine. Tells all about running, about breakdowns and repairs. Convenient pocket size, bound in leather, $1.00.

"Catechism of the Steam Plant." Hemenway. Contains information that will enable a man to take out a license to run a stationary engine. Tells about boilers, heating surface, horse power, condensers, feed water heaters, air pumps, engines, strength of boilers, testing boiler performances, etc., etc. This is only a partial list of its contents. It is in the question and answer style. 128 pages. Pocket size. Price, 50 cents.

"Care and Management of Locomotive Boilers." Raps. This is a book that ought to be in the hands of every person who is in any way interested in keeping boilers in safe working order. Written by a foreman boilermaker. Also contains several chapters on oil-burning locomotives. Price, 50 cents.

"Locomotive Link Motion." Halsey. Any person who gives a little study to this book ceases to find link motion a puzzle. Explains about valves and valve motion in plain language, easily understood. Price, $1.00.

"Machine Shop Arithmetic." Colvin and Cheney. This is a book that no person engaged in mechanical occupations can afford to do without. Enables any workman to figure out all the shop and machine problems which are so puzzling for want of a little knowledge. We sell it for 50 cents.

"Firing Locomotives." Sinclair. Treats in an easy way the principles of combustion. While treating on the chemistry of heat and combustion is easily understood by every intelligent fireman. The price is 50 cents.

"Air-Brake Catechism." Conger. Nothing better can be found for persons trying to learn all about air brakes. Tells the whole story. We sell it. Cloth, 75 cents. Leather, $1.00.

"Skeevers' Object Lessons." Hill. A collection of the famous object lesson stories which appeared in this paper several years ago. They are interesting, laughable and best of all they are of practical value to-day. $1.00.

"Stories of the Railroad." Hill. Best railroad stories ever written. Those who have not read these stories have missed a great literary treat. $1.50.

"Block and Interlocking Signals." Elliott. Tells what signals are, what they do and how they do it. Comprehensive treatise on the subject. Ought to be studied by all trainmen where block signals are used. $3.00.

"Standard Train Rules." This is the code of Train Rules prepared by the American Railway Association, for the operating of all trains on single or double track. Used by nearly all railroads. Study of this book would prevent many collisions. Price, 50 cents.

"Mechanical Engineers' Pocket Book." Kent. This book contains 1,100 pages 6x3¼ inches of closely-printed minion type, containing mechanical engineering matter. It ought to be in the book case of every engineer who takes an interest in engineering questions. We use it constantly as a reference for questions sent to us to be answered. Full of tables and illustrations. Morocco leather. $5.00.

"Locomotives, Simple, Compound and

Electric." Reagan. An excellent book for people interested in any kind of locomotive. It will be found particularly useful to men handling or repairing compound locomotives. It is the real locomotive up to date. $2.50.

RAILWAY AND LOCOMOTIVE ENGINEERING. Bound volumes. $3.00.

Business Dull at the Manchester Locomotive Shops.

Most of the locomotive building shops are so busy that it is strange to read of workmen being laid off, but this has happened at the Manchester shops of the American Locomotive Company, where 157 men were laid off. Those affected were mostly planers and drillers, the new hands and the night force suffering greatest.

The boiler and blacksmith shops had only half the regular force at work, due to lack of stock, but those are not included in the number laid off.

At present, the working force of the company, both night and day crews, consists of only about 300 men, the general force being about 600 hands.

The Peterborough Hydraulic Power Company, of which Senator Geo. A. Cox is president, is building a new power plant on the Otonabee River in the Town of Peterborough, Ontario, Canada, which will be equipped with the following apparatus, recently purchased from the Westinghouse Electric & Manufacturing Company: A 1,500 kilowatt, 2,240 volt generator, having 7,200 alternations and running at 150 revolutions per minute, to be direct connected to water wheels; also two 125 volt, D. C., direct coupled exciters of 75 kilowatts capacity each; together with switchboard consisting of a large generator panel and two exciter panels. This power house, when completed, will be an unusually fine one and is to furnish power to the Peterborough Mill of the American Cereal Company, owned by the Quaker Oats Company; power will be supplied to several other manufacturing plants in the town, and also to the Peterborough Light & Power Company, which does the electric lighting and small power business in Peterborough.

The Heffernan Engine Works filed articles of incorporation in the county auditor's office, at Seattle, last month. J. T. Heffernan and Nellie Gertrude Heffernan are the incorporators. The capital stock of the company is placed at $50,000. Mr. J. T. Heffernan was a regular contributor to LOCOMOTIVE ENGINEERING a few years ago.

There has been considerable talk about the dangers that will be incurred riding in the Interurban Rapid Transit tunnels in New York, due to cars being set on fire by accident and the electric mechanism. The terrible accident which happened in Paris last month where some sixty people lost their lives, seems to be looked upon as a dreadful warning.

We feel assured, however, that the cars under construction for the underground railways in New York will be absolutely fire proof, even when the worst kinds of accidents happen. They are built mostly of steel, and floors and doors will be coated with fire proof material.

For the last year we have found a great many newspaper articles about the Standard Motive Power Co., a $10,000,000 concern, which was building immense shops at Canaldover, O., for the construction of what is known as the Dodge locomotive. The locomotive is a freak of the worst kind, and now the company that was trying to float it against nature's laws have fallen into the mire themselves. A receiver was lately appointed for the company.

The Compensating Valve Co., Wilmington, N. C., are making a throttle valve that is worthy of general application. The ordinary throttle valve is a triumph of bad designing. To say that it is balanced is distorting facts; it is secured in the dome as if it would never have to be looked at, with the result that grinding the joint is a job to dread. The company's new valve designed by Mr. J. S. Chambers is quite the reverse. It is a finely balanced valve and the stand is designed so that a man can get inside the dome. It is a great comfort to engineers, who ought to insist that their engines be equipped with this valve.

Mr. Charles T. Chapin, president and superintendent of the Rochester Car Wheel Works, who is very well known to railroad men, has been engineering a trust to absorb all the car wheel makers of the country. His scheme worked very smoothly until he struck the Massachusetts car wheel makers, who would have nothing to do with the deal. It looks as if Mr. Chapin's trust plan was not thriving so well as he expected it would do.

The Chicago, Burlington & Quincy Railroad Company are extending the practice of subjecting wooden ties to preserving processes before they are put into the track, and it is said to be one of the best investments the company has ever undertaken. To pickle a tie costs from 10 to 12 cents and the process doubles its life which is a good investment considering that ties cost over 70 cents each.

The first railway was opened in Canada in 1836. It extended from La Prairie to St. Johns.

A Breakdown Question.

Should or could a compound engine, being towed under the following conditions, form enough compression to knock a cylinder head out? She was towed in with rods up and valve connected and traveling at very near full stroke. I claim it is impossible for engine to form any more compression then than she does in drifting every trip on her train.

ENQUIRER.

An engine being towed under these conditions blew out, or, I should say, knocked out a high pressure head. However, the big nuts on back pistons were both loose, and I claim that this running at a pretty high rate of speed did the damage, and that it was not due to any compression.

M. H. BLOUNT.

We agree with our correspondent's opinion.—Ed.

The Joseph Dixon Crucible Company, of Jersey City, N. J., have just issued a little book called Dixon's Index for Pencil Users. Now, as civilized mankind are pencil users, the catalogue—for such it is—should reach a very large audience. The Dixon Company manufacture so many varieties of pencils for "all sorts and conditions of men" that this index is intended to make easy the selection of a pencil suitable for a particular use. Stenographers, office men, station agents, telegraphers, trainmen, everyobdy in fact, are included in the index. For instance, if you are a car inspector you look up your vocation in index and then on turning to page 11, you will find that No. 303 is the pencil for you, as it meets the requirements of M. C. B. Association for making out defect cards, etc. Thus you are lead to the pencil which you should have. If you happen to be a draughtsman the page for your calling will explain the kind of pencils which are suitable for your work. This enables you to know what you want—which is a great thing—and you can ask for it, and if you like you can "take no other," as some old advertisements of food used to advise. We think we are justified in saying that this index "fills a long felt want." Write the Dixon Company for the index.

A Celebrated Engine Driver Turns Designer.

A curious form of express locomotive has been designed by Mr. Michael Reynolds, the well-known English writer on locomotive operating subjects. Engine and tender are enclosed in a house which makes it look like a long passenger car, only that a single pair of driving wheels, 10-feet diameter, and a pair of diminutive smokestacks indicate the engine. There is a 4-wheel truck in front, followed by a pair of carrying wheels set in front of the huge drivers. The tender is carried on two 4-wheel trucks. The cab is on the front platform and behind the engineer's seat is one for a "cleaner." The fireman's place is behind the fire box, which is very short.

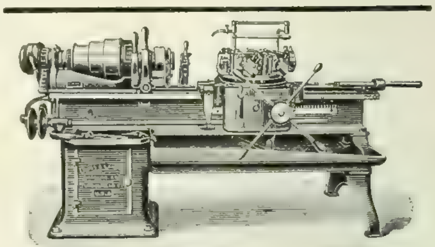
We are not impressed with Mr. Reynolds' ideas as a locomotive designer. His engine is decidedly inferior to one designed by the Erie locomotive engineers and exhibited at the Chicago World's Fair. Locomotive engineers so far have been more successful in running than in designing locomotives. There is a wise Latin saying, *Sutor ne supra crepidam judicaret.*

The Chicago, Burlington & Quincy shops at Aurora, Ill., are working on an order for a thousand box cars. The shops are turning out thirty-six cars a week. There was a movement at one time to close up these shops and get all the cars built in contract shops, and the change, which would have been a serious blow to Aurora, was averted by Mr. G. W. Rhodes, who was then Superintendent of Motive Power. He made a careful investigation of the capacity of the shops and found that they could build cars cheaper than the company could buy them, and they have been doing the work ever since.

The people of Cleveland seem determined to secure the convention of the Fireman's Brotherhood, which had arranged to meet at Buffalo next year, and they have offered to spend $20,000 for the entertainment of the delegates. They think the money will be well spent, as they expect that during a few weeks of the session the firemen will spend at least $200,000. The business men of Buffalo do not appear to realize what they are going to miss and the appearance is that the convention will go to Cleveland.

Someone has been kind enough to send us a small pamphlet with the caption "Her First Run." It tells about a Chicago girl running alone a locomotive for a wager over the Alton Railroad. The work done by this society Amazon was to hold her hand on the throttle while the engineer sat beside her and did the work. We have no patience with sensational fads of this character.

The Chicago Car and Locomotive Works has been incorporated with $100,000 authorized capital stock, has acquired the plant of the Pease Car and Locomotive Works at Hegewisch, Ill., and placed the works in full operation. The capacity of the plant is being increased. L. H. Baldwin is president and treasurer, and E. Gaidzik secretary.



Committees for Conducting the Work of the American Railway Master Mechanic's Association for the Year 1903-1904.

1.—Ton-Mile Statistics:

To confer with the American Railway Association regarding the mileage allowance for switching engines, and make positive recommendation to the Convention of 1904.

C. H. Quereau, Chairman,
G. R. Henderson,
G. L. Fowler.

2.—Coal Consumption on Locomotives:

As affected by enginemen, size of boilers and grates, loss of time on side tracks, ash pits, terminals, etc.

H. T. Herr, Chairman,
S. K. Dickerson,
R. L. Ettinger.

3.—Locomotive Front Ends:

To assist in tests being conducted at Purdue University, La Fayette, Indiana, by the *American Engineer and Railroad Journal*, and carry on the tests outlined in its report at the 1903 Convention.

H. H. Vaughan, Chairman,
F. H. Clark,
Robt. Quayle,
A. W. Gibbs,
W. F. M. Goss.

4.—Locomotive Driving and Truck Axles and Locomotive Forgings:

To follow up the proposed specifications as submitted, and make final report after the meeting of the International Railway Congress in 1905.

F. H. Clark, Chairman,
E. B. Thompson,
F. W. Lane.

5.—Boiler Design:

To investigate (1) the proper location of water glasses and gauge cocks in relation to the crown sheet and center line of boiler; (2) the proper slope of crown sheet expressed in inches per foot of length; (3) is the automatic low water detector a desirable attachment for general use on locomotives; (4) the destruction of side sheets in wide fire boxes, and the reasons therefor; (5) the best form of radial stays; (6) boiler tubes, with especial reference to length, arrangement and spacing to improve circulation and reduce the trouble from leaky flues.

D. Van Alstine, Chairman,
C. E. Fuller,
O. H. Reynolds,
H. T. Bentley,
Prof. W. F. M. Goss.

6.—Revision of Standards:

To revise the present standards on (1) shrinkage allowances, to provide for the necessary difference between cast iron and cast steel centers, providing for the larger diameter tires, 70-90 inches; (2) to revise boiler and fire box steel specifications; (3) to revise specifications and tests for boiler tubes, providing for both steel and iron tubes; (4) to revise specifications and tests for cast iron wheels for engine trucks and tenders.

T. A. Lawes, Chairman,
Wm. Forsyth,
Wm. Garstang.

7.—Air-Brake and Signal Instructions:

To revise the present Air-Brake and Signal Instructions. To confer with committees of the Master Car Builders' Association and Air-Brake Men's Association.

A. J. Cota, Chairman,
T. R. Browne,
G. W. Wildin.

8.—Piston Valves:

To conduct tests as outlined by report of committee at Convention of 1903.

Wm. McIntosh, Chairman,
J. A. Pilcher,
H. F. Ball,
G. R. Henderson,
C. B. Young.

9.—Electrical Equipment of Shops and Shop Power Houses:

To investigate (1) what do the manufacturers need to consider in order to more fully and satisfactorily meet the special requirements of railroads as to electrical machinery; (2) motor driving for shops; what are essential principles of successful systems? What are the possibilities and limitations of variable speeds in railroad shop practice; (3) all things considered, what is the most satisfactory system for railroad shops as developed in actual practice?

C. A. Seley, Chairman,
L. R. Pomeroy,
R. V. Wright,
R. Atkinson,
E. D. Bronner.

10.—Automatic Stokers:

Has past experience led to the belief that they may be satisfactory for general use on locomotives?

J. F. Walsh, Chairman.
H. T. Herr,
J. G. Neuffer.

11.—Locomotive Frames:

To consider (1) the question of large locomotives with reference to a study of the causes of breakage; (2) how shall distortions, both vertical and horizontal, be provided for, and which deflection is most necessary to provide for or prevent? (3) which is the better material, cast steel or wrought iron?

S. M. Vauclain, Chairman.
J. E. Sague,
Reuben Wells,
S. Higgins,
Alfred Lovell.

12.—Cost of Locomotive Repair Shops:

The following sub-headings are suggested:

1. Power Plant. Cost per horse power, separating boilers, engines, generators, buildings, coal and ash handling facilities, piping, switchboard, etc.

2. Locomotive Shops. Cost per cubic foot, and cost of machinery on basis of horse power of tools and tool list.

3. Countershafting. Relative cost of direct drive as compared with countershafting.

4. Piping. Cost of air, water and steam.

R. H. Soule, Chairman,
L. R. Pomeroy,
T. H. Curtis,
S. F. Prince, Jr.,
A. E. Manchester.

13.—Safety Appliances for Locomotive Front Ends:

J. F. Deems, Chairman,
W. S. Morris,
J. Milliken.

14.—Subjects:

H. Bartlett, Chairman.
J. F. Deems,
A. W. Gibbs.

The gross earnings of the Chicago Great Western Railway (Maple Leaf Route) for the second week of June, 1903, show an increase of $13,602.63 over the corresponding week of last year; being an increase for the fiscal year of $121,178.36.

Law Concerning Grab Irons.

We have received a notice from Mr. Edward A. Moseley, Secretary of the Interstate Commerce Commission, to the effect that the law concerning Grab Irons on locomotives will not be enforced until October 15 of this year. In connection with this notice Mr. Moseley writes:

Herewith enclosed please find copy of an order issued by the Commission "In the Matter of Grab Irons on Locomotives," temporarily extending until October 15, 1903, the time of carriers to comply with the Safety Appliance Law in regard to grab irons on the front ends or sides near the front ends of locomotives.

This order was issued upon the application of the Atchison, Topeka & Santa Fe Railway Company. At the hearing held here on August 5 and 6, which was attended by representatives of a number of railway companies and also by representatives of railway employees' associations, it appeared that the proper location of grab irons or hand holds on the front ends or sides near the front ends of locomotives was a matter that had not yet been determined by the Mechanical Departments of the railroads, and that the subject is one which has been under discussion by the American Railway Master Mechanics' Association. This temporary extension of time within which to comply with the law was granted to carriers by the Commission to enable them to come to a satisfactory determination as to the proper location of these grab irons on the front ends or sides near the front ends of locomotives, and not with any view of authorizing the carriers to dispense with that requirement of the statute.

It was suggested at the hearing by railway employees' representatives, and generally acceded to by the railway representatives, that the employees as represented by their associations should be consulted with reference to the proper location of grab irons on the fronts and sides near the fronts of locomotives; and also, while the law does not specifically require it, that the use of a hand hold on that part of a locomotive would be greatly facilitated by the addition of a step. At some convenient date prior to October 15, 1903, the matter will come up for further hearing as to the time necessary to enable proper compliance with the statute in this respect, and of that hearing due notice will be given through the public press or otherwise as the Commission may determine.

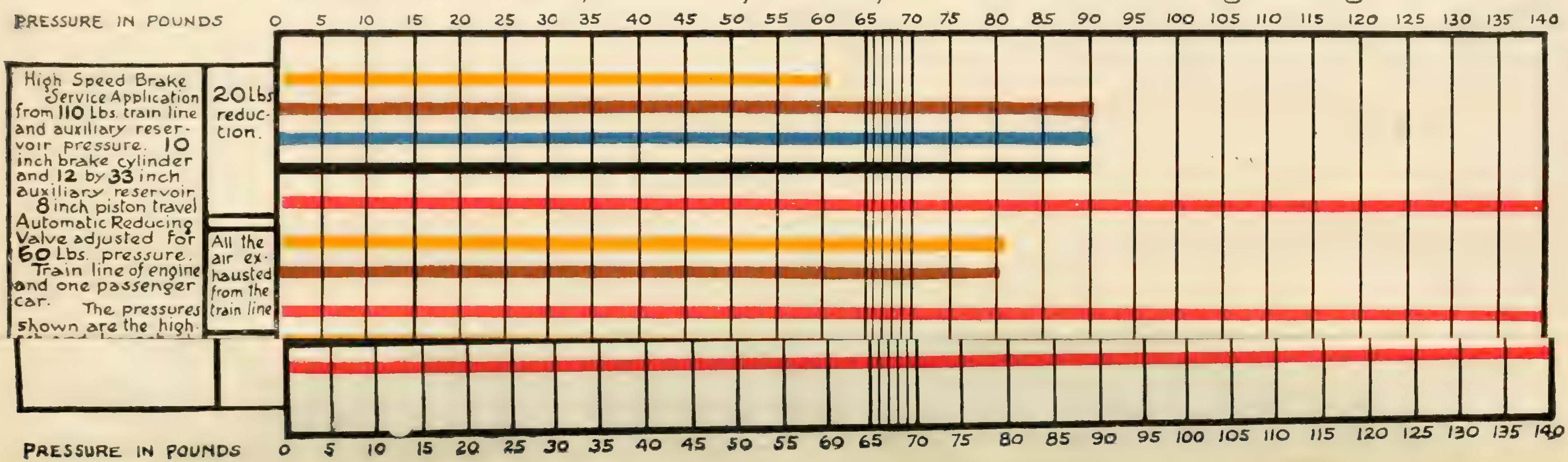
Edw. A. Moseley,
Secretary.

The hardest and best-borne trials are those which are never chronicled in any earthly record and are suffered every day.—*Old Curiosity Shop.*

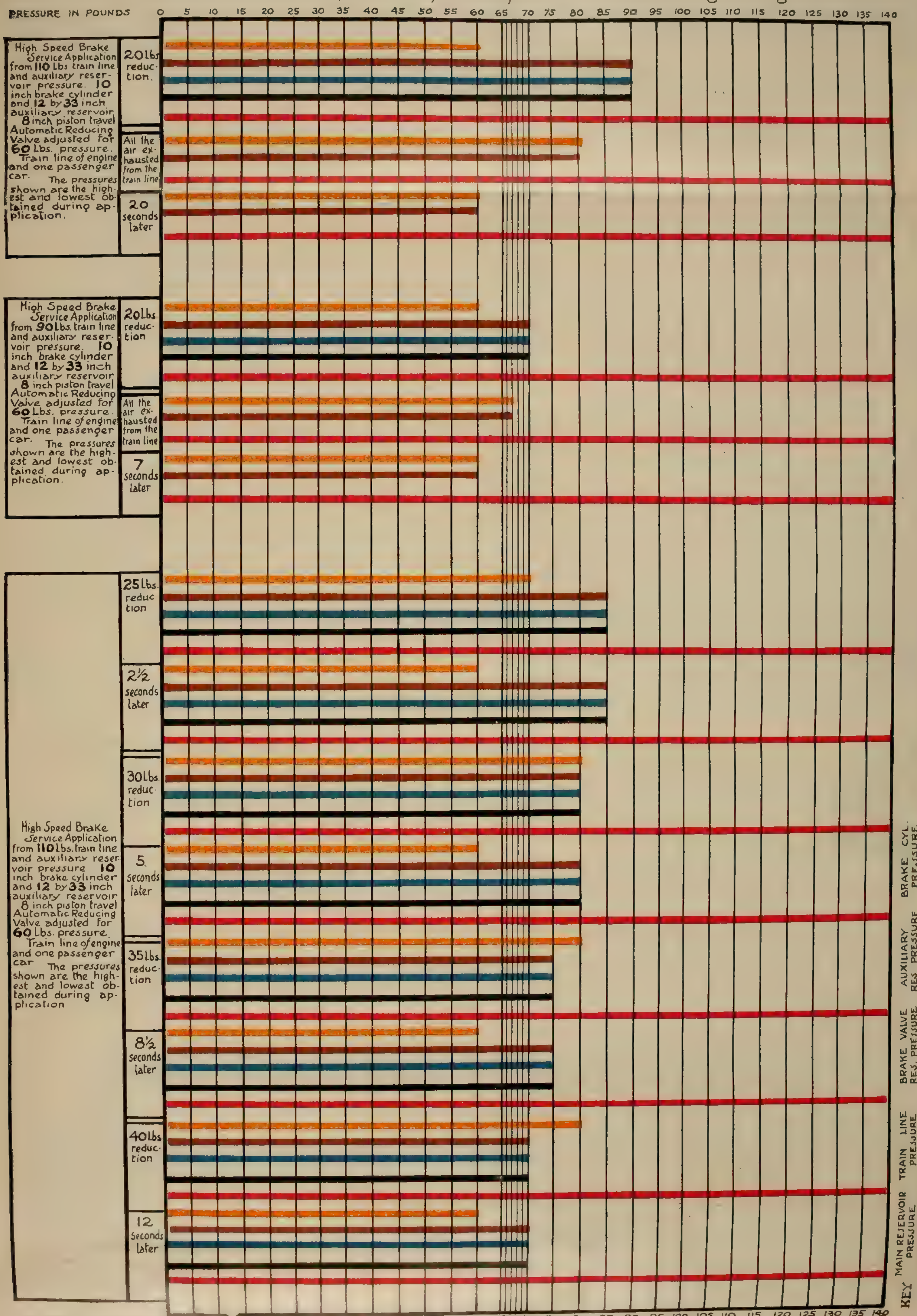
CONTENTS.

INDEX TO ADVERTISEMENTS.

OCTOBER, 1903. Color Air Brake Chart, Issued by Railway and Locomotive Engineering. SERIES No 3.



OCTOBER, 1903. Color Air Brake Chart, Issued by Railway and Locomotive Engineering. SERIES No 3.



DESIGNED BY E. G. DESOE, GENL AIR BRAKE INSPECTOR, B. & A. R. R., SPRINGFIELD, MASS.

Railway and Locomotive Engineering

A Practical Journal of Railway Motive Power and Rolling Stock

Vol. XVI. 174 Broadway, New York, October, 1903 No. 10

Power From Great Mountain Streams.

Those who are familiar with the immense power for manufacturing purposes taken from mountain streams in Switzerland and other countries are surprised that so little use has been made of running waters so abundant in the United States. Niagara Falls has, of course, been touched, but that case merely emphasizes this hemisphere, from which rivers of ice water of abundant volume and rapid descent constantly flow. According to the *Mail and Express*, it is proposed to impound a part of this melted snow and ice, and use the water power to develop electric currents, which can be transmitted to the place of their use, for trolley railways or for factories.

wheels to be installed will produce the estimated equivalent of the power of 20,000 horses. Other tubes and wheels can be added when there is a demand for more power. It is calculated that from this glacial source can be derived power sufficient for all the industries of the Puget Sound region.

The Swiss, who are utilizing water

UNION PACIFIC EXPRESS TRAIN

the absence of efforts to utilize other great opportunities.

This apathy toward opportunity is about to be broken by certain enterprising people in Washington State. Mount Tacoma, a huge peak, thirty miles from Puget Sound, whose altitude is 14,444 feet, a solitary cone, rising out of a level plain, has a cap of ice said to be the largest in

For this purpose the first dam is building at a point 1,900 feet above the sea and thirty-five miles from Tacoma. From this dam, just below the junction of the Mowich and Puyallup rivers, the water will flow eleven miles through a channel to a reservoir. Thence the water will fall 1,700 feet, through steel tubes, upon turbine wheels. The first four of these

power in a similar fashion, have named their glaciers "the white coal of the Alps." This compact description will apply with equal fitness to the eternal ice cap of Mount Tacoma. Its power is one of perennial renewal. The atmospheric moisture, the frost and the sun are the agents of this mighty alchemy of nature, that puny man thus turns to his

use. Utility cannot here interfere with beauty, as is threatened through the harnessing of Niagara or other majestic waterfalls.

The sublimity of the mountain glacier remains undisturbed, its grandeur unimpaired. The toll upon the generous, incessant flow from that impassive, majestic mass is imperceptible, even though it add to the forces of the industrial world the muscular power of armies. Ever the brilliant, shining peak freezes and melts, so long as wind blows and sun shines amid its lofty solitudes. Man grasps unnoticed at the hem of its mantle a bit of the largesse of nature.

Growth of the Locomotive.

BY ANGUS SINCLAIR.

(*Continued from page 401.*)

One of the pioneer locomotives still preserved is the "Mississippi," shown in Fig. 36. This engine belonged to the Natchez & Hamburg Railroad, now a part of the Illinois Central system. The meager history preserved of the engine says that it was imported from England about 1836, but I am inclined to doubt the correctness of this statement. It has none of the characteristics of any English builder of that period. It is on record that Samuel B. Dougharty, for some years assistant to W. T. James, had gone to work for H. R. Dunham & Co., of New York, who had engaged in the business of assembling locomotives, and that in 1836 he took several locomotives from New York to the Natchez & Hamburg Railroad. The likelihood is that the "Mississippi," now to be seen in the Field Museum of Chicago, was one of these. H. R. Dunham & Co. bought parts mostly in England, and put them together, making the minor fittings in their own shops, and contracting in New York for the boilers. In 1835 they built for the Engineering Transportation Company a locomotive which was spoken of as being the most thoroughly American locomotive ever built, so it is highly probable that the Mississippi was of a similar pattern.

There is in the Astor Library, New York, the drawing of a cow catcher made by Dunham, of the exact pattern used by Isaac Dripps on the Camden & Amboy John Bull, which Dunham recommended for locomotives. It had an arrangement for transmitting part of the weight from the forward drivers to the wheels supporting the cow catcher. The probabilities are that the Mississippi had the cow catcher originally and a single pair of leading wheels.

The latest record we have of the engine is, that in 1868 it was removed from Natchez to Vicksburg. It was used there switching for a time and was then put in a remote siding, where it became buried in sand, until 1878 when it was exhumed and put to work on the construction of the Meredian, Brookhaven & Natchez Railroad. When that short line was finished the Mississippi was employed pulling trains until 1891. The engine weighed 14,000 pounds, had cylinders 9½x16 inches and driving wheels 43 inches diameter.

FIG. 36

About the year 1845 Dr. Dionysius Lardner, a celebrated English writer on transportation problems, visited the United States for the purpose of investigating the progress of railroad construction. During his tour he traveled in Mississippi, probably behind the engine "Mississippi," and he thus describes part of the journey: "To the traveler in these wilds, the aspect of such artificial lines of transport (railroad) in the midst of a country a great portion of which is still in the state of native forests, is most remarkable and strongly characteristic of the irrepressible spirit of enterprise of its population. Traveling in the back woods of Mississippi, through native forests where, till within a few years, human foot never trod, through solitudes the stillness of which was never broken even by the red man, I have been filled with wonder to find myself drawn on a railway by an engine driven by an artisan from Liverpool, and whirled at the rate of twenty miles an hour by the highest refinements of the art of locomotion. It is not easy to describe the impression produced as one sees the frightened deer start from its lair at the snorting of the ponderous machine, and the appearance of the snake-like train which follows it, and when one reflects on all that man has accomplished within half a century in this region."

Dr. Lardner was a most bigoted Englishman, and he would not have failed to mention it if the locomotive had been of English manufacture.

PROGRESS IN LOCOMOTIVE DESIGNING AND BUILDING.

The year 1836 was celebrated for the successes achieved by Philadelphia locomotive builders. Baldwin built 40 locomotives, Campbell had designed a new type, Garrett & Eastwick had introduced a decided improvement in the equalizing levers, and William Norris, who had labored persistently against adversity, made a hit with one of his engines which brought him fame and fortune.

This was the "Washington," which made a wonderful record on the first section of what is now the Pennsylvania Railroad.

COL. JOHN STEVENS' ENTERPRISE.

I have already referred to the persistent efforts made by Colonel John Stevens to have railroads constructed instead of canals. As early as 1823 he obtained by an act of the Legislature of Pennsylvania authority to build a railroad from Philadelphia to Columbia. Mr. Stevens' spirit of enterprise greatly exceeded his financial resources, for he failed to begin the work within a specified time and the State Legislature three years later repealed the Stevens Act and passed another which intended to saddle the State with the burden of building the road. This came to naught, but two years later, in 1828, the Canal Commissioners of the State of Pennsylvania were ordered by the Legislature to put under contract the construction of a railroad from Philadelphia to Columbia via Lancaster. A liberal appropriation of money was made for the purpose and work on the enterprise was commenced with little delay.

PHILADELPHIA AND COLUMBIA RAILROAD.

The Philadelphia & Columbia Railroad, usually spoken of as the "State Road," was 82 miles long and the work of construction was done under Major John Wilson, who worked out the locating with decided ability the maximum grades having been only 30 feet to the

mile. At each end of the line there was an inclined plane, that at the Philadelphia terminus having been 2,805 feet long with a rise of 352 feet to the mile. The inclined plane at the Columbia end was 1,800 feet long, rising at the rate of 264 feet to the mile.

The purpose of the Philadelphia & Columbia Railroad was to make a through route from Philadelphia to the West as a rival to the Baltimore & Ohio, which was expected to draw Western products to Baltimore, and to hold for Philadelphia some of the business that the Erie Canal was taking to New York. A through route to Pittsburgh was established by means of canals and a portage railroad formed by a series of inclined planes.

The original scheme of operation for the Philadelphia & Columbia Railroad was to make it a public highway, on which any citizen of the State could operate cars on payment of a fixed toll. Horse power was used exclusively at first, except on the inclined planes, which were worked by stationary engines and rope traction.

OPERATING A RAILROAD AS A PRIVATE HIGHWAY.

Operating a railroad like a private highway worked very badly. Writing on the subject Soloman W. Roberts, a state official, says:

"The experiment of working the road as a public highway was very unsatisfactory. Individuals and firms employed their own drivers, with their own horses and cars. The cars were small, had four wheels and each would carry about seven thousand pounds of freight. Usually four cars made a train, and that number could be taken up and as many let down an inclined plane at one time, and from six to ten such trips could be made in an hour. The drivers were a rough set of fellows and sometimes very stubborn and unmanageable. It was not practicable to make them work by a time-table, and the officers of the road had no power to discharge them.

"When the road had but a single track between the turnouts, a large post called a center post was set up half-way between two turnouts, and the rule was made that when two drivers met on the single track, with their cars, the one that had gone beyond the center post had the right to go on and the other that had not reached it had to go back to the turnout which he had left. The road was, in many places, very crooked, and a man could not see far ahead. The way the rule worked was this: when a man left a turnout he would drive very slowly, fearing he might have to turn back, and, as he approached the center post, he would drive faster and faster, to try to get beyond it, and thus drive back any cars that he might meet, and in this way cars have been driven together, and a man killed by being crushed between them."

He also states that when a bill was pending in the State Legislature, to authorize the purchase of locomotives, he was journeying in a horse car toward Harrisburg and says:

"Two gentlemen were sitting opposite to me who were members of the Legislature from Chester county, one being a senator. The car stopped and a man spoke to my traveling companions, saying that he hoped they would oppose the bill to authorize the purchase of locomotives for the road. The senator said that it should never be done with his consent. Thereupon, as the car drove on, I proceeded to argue the matter, but with poor success; the reply being that the people were taxed to make the railroad, and that the farmers along the line should have the right to drive their own horses and cars on the railroad, as they did their wagons on the Lancaster turnpike, and that if they were not permitted to do it, the railroad would be a nuisance to the people of Lancaster and Chester counties. It required time to overcome this feeling."

LEGISLATURE CONSENTS TO THE PURCHASE OF LOCOMOTIVES.

In spite of their tender mercies for the interests of the farmer and of other horse owners, the Legislature of Pennsylvania were eventually compelled to consent to the use of locomotives on the State Railroad. When this decision was reached, a locomotive was imported from England for use on the Philadelphia & Columbia line. Great expectations were aroused about the wonderful performance this engine would display. As the line was not yet completed at the Philadelphia end, the locomotive was hauled over the turnpike road to Lancaster, where rail connection was reached.

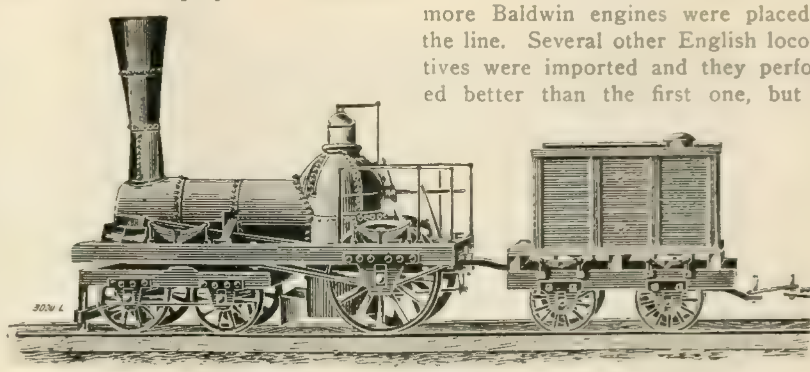
A BALKY LOCOMOTIVE.

The starting of the locomotive was an event which attracted crowds from far and near, and a holiday was declared for the occasion. Governor Wolf and the leading State officials participated in the ceremonies, and the day being fine a concourse of people gathered similar to the crowd which witnessed the first official trip made by the "De Witt Clinton," at Albany, N. Y., two years before.

Excitement was intense and the movements of the engineer were watched by thousands of eager eyes. He mounted to the deck, manipulated the starting levers, then pulled open the throttle valve, but the engine would not move. After the engineer had exhausted himself in vain to start the engine, the people, like most American crowds, were good natured, rushed in and pushed engine and train into motion. Good nature could not, however, deny that as a starter the English engine was a failure. It maintained its first reputation and its further history is lost in oblivion."

BALDWIN'S "LANCASTER."

Shortly afterward Mr. Baldwin in 1834 built the "Lancaster" (Fig. 37) for the Columbia line. That engine was similar to the E. L. Miller, and worked satisfactorily. The following year two more Baldwin engines were placed on the line. Several other English locomotives were imported and they performed better than the first one, but the American engines were much more popular than those imported.



BALDWIN'S LANCASTER FIG. 37

RIVALRY AMONG LOCOMOTIVE BUILDERS.

There was some rivalry among locomotive builders to display what their engines could do on the Columbia Railroad. William Norris concluded that he could build a locomotive that would work not only the level section but the inclined planes as well. The engine built for this purpose was called the "Washington," shown in Fig. 38. The engine was of his ordinary six-wheel type, a four-wheel truck in front under the smoke box and a single pair of drivers in front of the fire box. The cylinders, 10x18 inches, were outside the smoke box, the driving wheels were 48 inches diameter. The boiler was of the Bury pattern and carried 90 pounds steam pressure. The total weight of the engine was 14,400 pounds, the greater part of that resting on the driving wheels. In addition to that the tender coupling was so arranged that part of the tender's weight was thrown upon the driving wheels when the engine was pulling.

TRIUMPH OF THE "WASHINGTON."

When put to a test the Washington hauled a load of 19,200 pounds at a speed of fifteen miles an hour up the inclined plane at the Philadelphia end of the Columbia Railroad, which was 2,800 feet long, rising at a rate of 377 feet to the mile.

Some controversy arose concerning the correctness of this performance, some engineers insisting that it was an impossibility. When subjected to the testimony of figures it is found that the load was quite within the tractive power of the engine so long as no slipping occurred. The tractive power was about 3,000 pounds and the resistance of the train due to gravity was 1,181 pounds. The frictional resistance would not exceed 100 pounds.

Whatever may have been the merits of the performance of the George Washington, it brought fame upon its builders and was the means of launching the works upon a prosperous career. There was no longer any sneering at the "Billy" Norris engines being inferior to the best. The fame of the Norris engines for high tractive power brought a few years later the first order given by an English railway company for an American locomotive.

THE BAR FRAME.

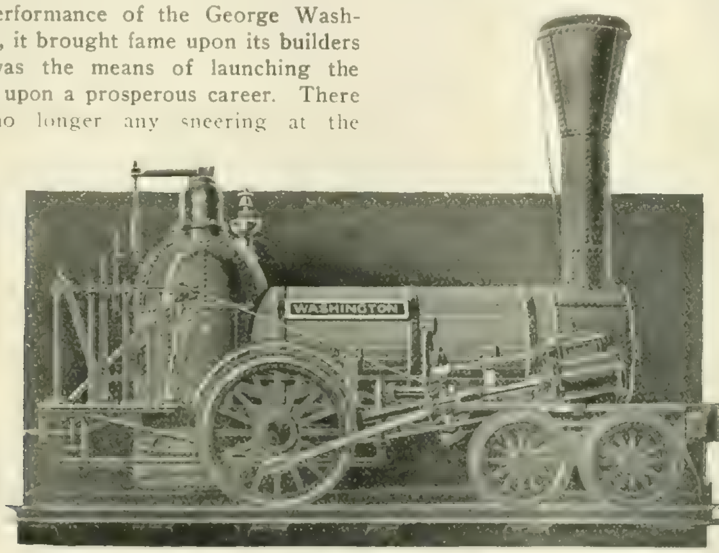
The bar frame was first applied to locomotives in the United States by Coleman Sellers & Son, who built locomotives in Philadelphia for a few years, but the invention became popular principally through its use on the Norris engines. There is no doubt that the bar frame was imitated from the Bury engine of the Petersburg Railroad. It made a simple form of carriage which ordinary blacksmiths could forge, and, that with its convenience for attaching mechanism which could be conveniently reached, made the bar frame popular with American locomotive designers and users and it came rapidly into favor.

THE LA FAYETTE.

The success of the Washington brought an order to Norris from the Baltimore & Ohio for one engine which was the first with a horizontal boiler used on that road, also the first with six wheels. The engine was delivered in 1837 and was called "La Fayette." It was of what had become the usual Norris form, outside cylinders, single pair of drivers in front of a haystack fire box, a four-wheel swiveling truck under the smoke box, and inside bar frames. The La Fayette was more squatty in appearance than the Washington, but the power was about the same.

THE COLUMBIA RAILROAD AS A TRAINING SCHOOL.

The Columbia Railroad early became a sort of training line for railroad men, just as the developed system of the Pennsylvania Railroad became a training school for railroad business on a larger scale, and it held the reputation until it became a hotbed of politics. Men who had worked on the Columbia Railroad claimed to be competent to act as leaders and supervisors on any other railroad in the country, and their claims were generally admitted as being well founded. In 1840 they had locomotives built by all American locomotive builders of the day, Baldwin, Norris, Coleman Sellers & Son, Eastwick and Harrison, of Philadelphia; Dotterer & Son, of Reading; John Brandt, of Lancaster; Ross Winans, of Baltimore, and others. Enginemen could experiment with so many different kinds of locomotives that they were considered capable of handling any engine that ran on wheels.



NORRIS' WASHINGTON.

STATE RAILROAD REPAIR SHOPS.

Shops were established for the railroad at Parkesburg, 44 miles west of Philadelphia. Great difficulty was at first experienced in effecting repairs in these shops from the fact that the nuts and bolts on the locomotives procured from a number of different locomotive establishments were all of different sizes and patterns, every bolt having its own corresponding nut. One of the first effective reforms made in this shop was the establishing of standard sizes of nuts and bolts, an action which was highly creditable to the men in charge, for standard sizes were little thought of in those days.

All general repairs of engines were done at the Parkesburg shops, and the running repairs were done at either end of the line by blacksmiths and helpers, whose duty it was to do the work under the direction of the engineers.

The payroll of the Parkesburg shops for September, 1843, gives the number of employees as thirty-one, including one manager, one foreman, thirteen machinists, three blacksmiths, one coppersmith, two file makers, one pattern maker three carpenters, one stationary engineer, four assistants and one watchman. The aggregate amount of the pay-roll for these thirty-one men for one month was $1,087.88, a little over $35.00 for each person.

The pay-roll of locomotive engineers and firemen employed on the Columbia Railroad during the month of August, 1843, shows that their number was forty —twenty engineers and twenty firemen. The standard rate of wages at that time and for some years previous to and subsequent to that period was $2.00 per day for engineers and $1.25 per day for firemen, the time paid for being that in which actual service was performed, and all accounts being verified by affidavits. The total payments for that month were $990.00 for engineers and $674.36 for firemen, being $40.50 for engineers and $33.21 for firemen. Of the twenty engineers, two were employed on a night line, two on a fast line, and sixteen in running "burden" or freight trains.

GROWTH OF COLUMBIA RAILROAD BUSINESS.

After locomotives were introduced the business of the Columbia Railroad increased very rapidly for a report made in 1836 by Mr. A. Mehaffey, superintendent of motive power, gives a table of the names of twenty-seven locomotives which he had at work and the mileage they had made. Of these eleven had been built by Baldwin, one by Long & Norris, four by William Norris, two by Coleman Sellers & Son, five by the Stephensons, three by Young, and one by McClurg & Co., Pittsburg.

In connection with this report Mr. Mehaffey said: "Owing to the infancy of the business of engine building and the deficiency of motive power last spring, some were necessarily purchased which have been a constant source of vexation, delay and expense. The running of these must ever be an actual loss to the State. Hereafter none will

be kept on the road except such as can do full work; all others will be disposed of as soon as possible consistent with the interests of the State. . . . Two of the engines of British make have recently been sold, and it would have been a saving to the Commonwealth had they been given away for nothing the first day they were placed upon the track."

They had a happy-go-lucky way of operating trains on the State road in those days. The stations were nearly all located at taverns, and it was the practice to stop long enough to permit the passengers and train hands to partake of liquid refreshments.

The rules for the running of trains were conspicuous by their absence. As late as 1840 trains were started only whenever those in charge of the motive power were assured that there was sufficient traffic along the line to warrant the use of locomotives. Belated trains were searched for by crews that were kept in waiting orders for the purpose. An extra engine with six or eight men was sent out whenever the occasion warranted, curves being "run," that is, a flagman sent out ahead until the delayed train was found.

The operating of this railroad by the State of Pennsylvania was far from being a success. It was managed in the interest of politicians, with the usual result that having interest with the political wire pullers was much more powerful in advancing employees than knowledge of their business or faithful service. The inertia of corruption kept the politicians in control for many years, but their authority was greatly curtailed before the final coup which turned over the whole of the property to the Pennsylvania Railroad Company in 1857.

(To be continued.)

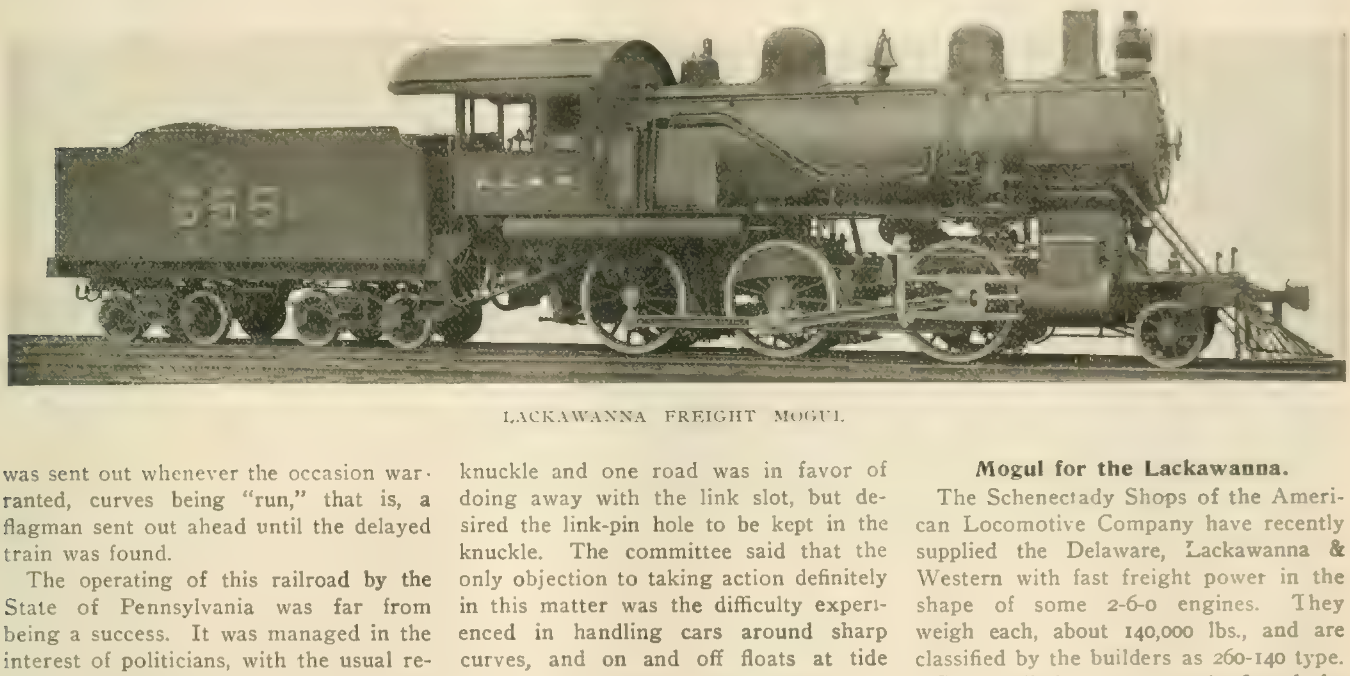
M. C. B. Coupler Tests.

The standing M. C. B. Committee on Coupler Tests, in making their report practically expressed the opinion that in the multiplicity of couplers now on the market a judicious weeding out process might be applied by specifying for new equipment only those couplers which had a lock-set in the head, and which do not depend entirely upon the uncoupling lever to hold up the lock. Dependence upon the lift rigging to keep the lock up presupposes that this part of the device shall always be in exact adjustment, which is not invariably the case in every day service. They further recommended that as cases often arise where, with cars coupled together, one knuckle can be opened more easily than another, that the uncoupling lever should be placed on both sides of every car, thereby giving a man two chances instead of one to cut or uncouple cars as the case may be.

A circular was sent out asking for an expression of opinion as to whether link slot and link-pin hole in the knuckle might not now be abandoned with advantage. Twenty-one roads replied. In this number there were nineteen which had been for some time using the solid knuckle and they were very much in favor of making it standard. One road reported no experience with the solid knuckle and one road was in favor of doing away with the link slot, but desired the link-pin hole to be kept in the knuckle. The committee said that the only objection to taking action definitely in this matter was the difficulty experienced in handling cars around sharp curves, and on and off floats at tide water. The committee had, however, experimented with an auxiliary device which seemed to meet the requirements of the case, and which they brought officially before the association, through the medium of their annual report.

The committee pointed out that the elimination of link slot and link-pin hole in the knuckle would transfer almost the entire breakage of knuckles to the pivot pin hole in the knuckle and to the coupler lugs, and that in order to give these parts the necessary additional strength, an increase in section rather than in depth would be desirable. They argued that "metal around a deep hole will tear at the point of greatest shear as readily as it will around a hole of less depth of the same section." The committee further indicated that the present contour had been designed for lighter service than exists to-day, and they believed that manufacturers were now making stronger couplers than formerly and that the limit of strength with present contours had practically been reached. An altered contour was suggested which would make the knuckle somewhat more hook-shaped and would gain 3-32 of an inch across the contour at the pivot pin-hole. The recommendation is to still use the 1⅝-in. pivot pin in a coupler 11 or 12 inches deep with a solid knuckle having a 9 or 10 inch face, and with the improved contour, which would, of course, couple with existing equipment. This compromise plan makes possible further evolution along similar lines, as the future may render present conditions more strenuous or may even impose other limitations upon the skill of the designer or of the manufacturer.

The railroad companies leading to St. Louis are making special efforts to meet the rush traffic expected for the exhibition.



LACKAWANNA FREIGHT MOGUL.

Mogul for the Lackawanna.

The Schenectady Shops of the American Locomotive Company have recently supplied the Delaware, Lackawanna & Western with fast freight power in the shape of some 2-6-0 engines. They weigh each, about 140,000 lbs., and are classified by the builders as 260-140 type.

The cylinders are 20½x26 and the diameter of the driving wheels amounts to 63 ins. All wheels are flanged. The pony truck and the leading driver are equalized together and the two rear drivers are also equalized together. The calculated tractive effort of this engine with 200 lbs. steam pressure in the boiler is about 29,500 lbs. The engine is simple, with Allan-Richardson balanced valves, actuated by indirect motion. The crosshead is of the two-guide bar type and has a lip cut on each side of the upper guide, so that outside of guide and crosshead side are flush. The piston rod is not secured to the crosshead by key, but has a shoulder on the rod drawn up tightly with a couple of nuts.

The boiler is of the straight top variety, with wide fire box. The diameter of the

first ring is 66¼ ins. The fire box has a grate area of 53.43 sq. ft. The heating surface is 2,342.2 sq. ft. in all, the fire box giving 166.2 sq. ft. The tubes which are 310 in number, are 13 ft. 6 ins. long and contain 2,176 sq. ft. of heating surface. The crown and roof sheets are level and the back sheet is perpendicular, and the staying is radial. The fire door has curved and flat lines in its contour. The sides are made each with 6 ins. radius and the bottom upon which the scoop rests when delivering coal, is flat, while the upper edge of the door is arched, with a 22¾ in. radius.

The tender has an ordinary U-shaped tank, which holds 6,000 U. S. gallons ot water. The tender weighs empty 49,400 lbs., and is carried on two diamond arch bar trucks. There are two main reservoirs for air. Ten tons of coal is carried.

A few of the principal dimensions are here given for reference:

A COLORADO BOILER EXPLOSION. ENGINEER AND FIREMAN KILLED.

General Dimensions—Weight in working order, 161,000 lbs.; weight on drivers, 140,000 lbs.; weight engine and tender in working order, 280,400 lbs.; wheel base, driving, 15 ft.; wheel base, total, 23 ft. 10 ins.; wheel base, total, engine and tender, 52 ft. 54 ins.

Cylinders—2[illegible] x 26 ins.; size of steam ports, 18 x 1¾ ins.; size of exhaust ports, 18 x 3 ins.; size of bridges, 1⅜ ins.

Valves—Allen Richardson; greatest travel, 5½ ins.; outside lap, 1 in.; inide clearance, 1/16 in.; lead of valves in full gear, 1/16 in.; lead ¼ in. at 6 in. cut off.

Wheels—Dia. of driving wheels outside of tire, 63 ins.; engine truck wheels, steel tired spoke, tire 2½ ins.

Boiler—Thickness of plates in barrel and outside of fire box [illegible] ½, ¾, 11/16 ins.; fire box, length, 102¼ ins.; fire box, width, 75¼ ins.; fire box, depth, front, 63¾ ins.; back, 56½ ins.; fire box plates, thickness, sides, ⅜ in.; back, ⅜ in.; crown, ⅜ in.; tube sheet, 9/16 in.; fire box, water space, 4 ins. front; 3½ ins. sides; 3½ ins. back; fire box, crown staying, radial; tubes, gauge, No. 12 B.W.G.; tubes, number, 310; tubes, dia., 2 ins. heating surface, tubes, 2,176.00 sq. ft.; heating surface, fire box, 166.2 sq. ft.; heating surface, total, 2,342.2 sq. ft.; grate surface, 53.43 sq. ft.

Tender—Weight, empty, 49,400 lbs.; wheel base, 16 ft. 9½ ins.; tender frame, 10 ins. steel channels; water cap., 6,000 U. S. gals.; coal cap., 10 tons.

Improvements on the Pittsburgh & Lake Erie at McKees Rocks, Pa.

The Pittsburgh & Lake Erie Railroad are making some very extensive improvements at their Pittsburgh Shops, situated at McKees Rocks, Pa. A new shop building has just been put up which is 170 feet wide by 525 feet long. The twenty-four pits in the erecting shop bay are served by a 10-ton and by a 120-ton electric crane. The pits run parallel with the end walls of the building. The heavy machine bay is covered with a 10-ton crane and the light machine bay is served by air hoists, light travelers, etc. The shop is very similar in general layout to that of the L. S. & M. S. shops at Collinwood, a description of which we gave last November.

The machines are not yet fully in place in the P. & L. E. shop, but when completed every machine will have an individual electric drive with the sole exception of half a dozen bolt cutters which will be driven in a group with one piece of shafting. Thus there will be no belts or shafts anywhere, except at this one point. The roof arrangement of this shop is interesting. The erecting bay is covered with a roof of somewhat flat pitch, sloping both ways from the center. For the heavy and the light machine bays the saw-tooth form of roof is used with the upright portion of the wall, corresponding to the vertical edge of the saw-tooth, made of glass. This gives two large areas of glass placed so as to be affected very little by snow or ice, and with the additional advantage that condensation of vapor and the drip of moisture is taken off through gutter pipes placed at regular intervals. A striking feature of the saw-tooth roof, here, is that a spectator standing a few feet away from the line of the erecting shop posts and looking away from that shop, sees two enormous unbroken areas of clear glass, which, assisted by the wall windows, throw a flood of light into and upon the floor of the erecting shop, as well as lighting the other two.

In the paint shop this effect is even more marked, as there are more "saw-teeth" to shed light and the vertical light of the glass area is greater in proportion. The shops throughout are heated by the Sturtevant system. In the wood-working department the shafting for all the machines are below the floor and this has the effect of apparently giving more room and of certainly giving more light to the workmen.

There are also two roundhouses of modern design, having together sixty-eight stalls. In each roundhouse there are two tracks fitted up with drop pits for driving wheel work, and two other pits in each shop are arranged for dropping tender wheels at one end, and for dropping engine truck wheels at the other end of the same shop pits. The ordinary pits for each stall are made of concrete and are sloped up in the center. Steel roller doors are used in both roundhouses, and Mr. D. J. Redding, the master mechanic in charge, speaks very highly of their efficiency in keeping warm air in and cold air out during the winter months.

In the matter of lighting and ventilation these roundhouses are well constructed. No. 1 roundhouse is of the usual form, the back or turn-table end having the lower wall; but from the top of higher wall, toward which the engines face, rises a Mansard roof, which is pierced with windows, which, together with those in the higher wall, supply more light than usually finds its way into an engine house. No. 2 house has in addition to the Mansard roof, a hip roof, or rather a box of square section with slatted vertical sides, which being placed in the highest point of the roof, acts as a very effective ventilating and smoke removing medium. The smoke jacks used are of unique design, the illustration of which we have reserved for a future issue. Altogether, shops, roundhouses, power plant, etc., present an example of a thoroughly well-designed and modern railroad repair plant, and when in full operation will greatly augment the facilities of the Pittsburgh & Lake Erie to cope with their ever increasing business.

The latest title given to J. Pierpont Morgan is "King of Wall Street." The title is not in derision either, for there is no doubt that Mr. Morgan is the real monarch of all he surveys in the atmosphere of that street.

Schmidt Steam Superheater.

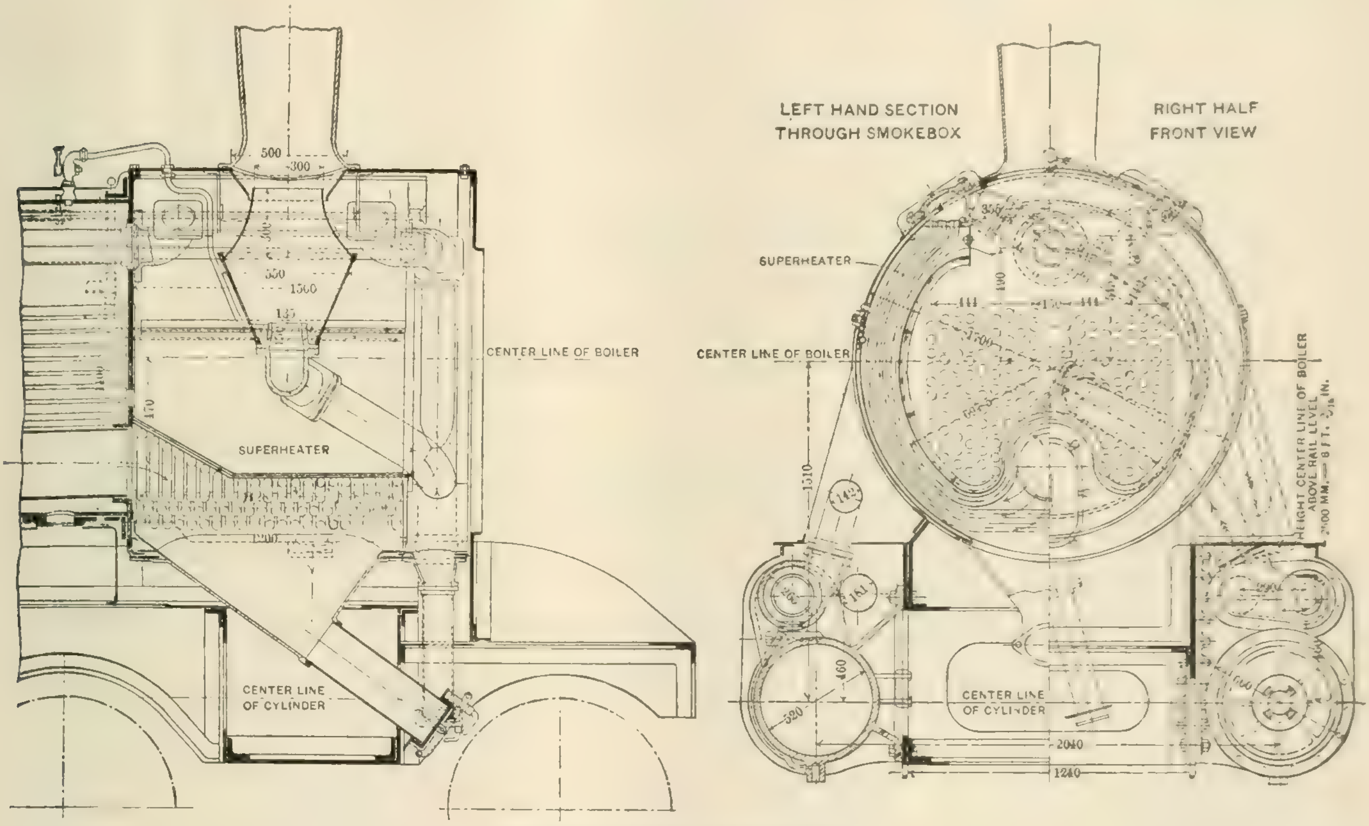
Varied attempts have been made at different times to establish the use of superheated steam on locomotives, says the *Locomotive Magazine*, from which we reproduce illustrations and description, but hitherto the majority of the efforts have resulted in failure due to the difficulties of construction and trouble of the superheating devices. The Prussian State Railway Administration, however, claims to have secured a more favorable arrangement of apparatus, and has applied it to some 60 or 70 locomotives. The device is known as the Schmidt superheater, and we give a drawing of the apparatus as installed in the smokebox of a locomotive. Applied originally to stationary engines, considerable doubt existed for a time among German locomotive engineers as to the advisability of adopting it on locomotives, but apparently in service it has convinced critics of its economy.

Superheated steam must possess certain advantages, and among them are the increase in the boiler efficiency (25 per cent. is claimed), and the absence of condensation in the cylinders, a serious element of loss on ordinary locomotives.

As this superheater is placed in the smokebox it necessitates the latter being made much larger both in diameter and length, but the additional expense in construction is not excessive, the extra cost being comparatively slight.

It is stated that a locomotive using superheated steam at a pressure of 85 pounds per sq. in. will give as economical results as an ordinary "saturated" steam engine will at 170 pounds per sq. in., and with steam at a temperature of 572 degrees F. it is possible to run without any cylinder condensation with pressures as low as 70 pounds per sq. in.

The Prussian State Railways have four different types of superheated steam locomotives, which are intended to deal with all classes of traffic, thus reducing the variety in engines, as it is claimed for superheating that the power of individual engines can be considerably increased.



SCHMIDT STEAM SUPERHEATER

Train Nearly a Day Late.

The sale of the Indiana and Illinois Railroad to the Illinois Central last week recalls an amusing story. When the Switz City division of the Illinois Central was built it was known as the Indiana and Illinois Southern. It was a narrow-gauge road, the roadbed was bad, the engines and cars were built on a miniature scale, and while there was a schedule, had a train been on time the fact would have been regarded as a miracle. The road was known as the "Try-Weakly."

About twenty years ago Josiah McConnell desired to go to Switz City from Sullivan, but missed the train by a minute or two. The clock at the station showed that the train had left Sullivan five minutes ahead of time, and McConnell sued the railroad company for $5,000 damages. On a trial of the case, it was proved beyond a doubt that the train McConnell missed should have gone the day before, and was really twenty-three hours and fifty-five minutes late.—*Indianapolis News.*

At the Traveling Engineers' Association meeting held in Chicago on 8th and three following days of September, a resolution of sympathy with the wife and children of the late P. M. Arthur was unanimously passed. In referring to the departed Grand Chief the association expressed itself as mourning the loss of an honored and respected member, and joined with the Brotherhood of Locomotive Engineers in sorrowing over the loss to them of a wise and efficient leader, and united with every association of labor worthy of the name in lamenting the death of a counsellor, guide and true friend. The death of P. M. Arthur—the resolution concludes—has left a gap in ranks of the successful conservative labor leaders, which all alike realize will be difficult to fill.

We are always ready to excuse the printer and reporter for the mistakes they make, but when they use the word mongrel instead of mogul and repeat the misnomer three times in the course of one column, we cannot suppress a suspicion that it was a case of malice aforethought.

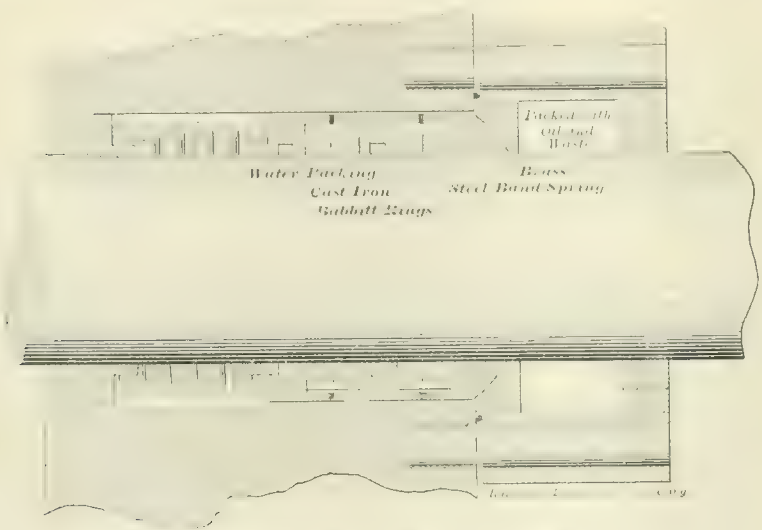
Nothing can be won without anxiety and care.—*Old Curiosity Shop.*

German Freight Cars.

Mr. B. H. Warner, Jr., United States consul at Leipzig, Germany, writes to the Department of Commerce as follows:

"The carrying capacity of the average German freight car is from 10 to 15 metric tons. Recently the Vereinigte Konigs und Laurahutte Aktiengesellschaft fur Bergbau und Huttenbetrieb, one of the greatest manufacturing and industrial establishments of the empire, received an order from the Prussian State Railways for 200 freight cars, each of 20 metric tons capacity. The railroad authorities are now discussing whether it will be wise to still further increase the car capacity. While they are busy investigating the subject and gathering statistics relating thereto, it has been decided to have a few cars, each of 30 tons carrying capacity, constructed, in order to make a practical test as well."

A metric ton weighs 2,204.6 pounds.



MADDOX PATENT PISTON PACKING

Maddox Piston Packing.

Annexed is a drawing of a metallic packing, the invention of Mr. S. J. Maddox, an employee of the Illinois Central Railway. It has been put to the severest test on suburban engine No. 1411, of the I. C. Ry. for twenty-one months, and the piston rod has shown only $\frac{1}{100}$ inch wear in that time.

The packing has also been tested with equally good results at the Burnside shops of the same company on a Buckeye high speed engine making over 300 revolutions per minute.

There are two features of the invention that recommend themselves. The drawing shows two grooves which collect the condensation and which are intended to keep the piston rod moist and act as anti-friction agents in addition to the oil packing.

There is also a steel spring band which keeps the packing in place.

Mr. Maddox guarantees the packing to outlast the life of a pump, and to prevent the escape of steam on valve-stems and pistons so annoying and wasteful on our large engines.

Water Softening in Relation to Washing Out, on Railways.

The mechanical department of the Pittsburgh & Lake Erie Railroad, which is presided over by Mr. L. H. Turner, as superintendent of motive power, is making an extensive instalment of Kennicott water softening plants at various points along the line. The plant, which is situated at the McKees Rocks shops, at Pittsburgh, will handle the company's daily consumption of water at that point, which now ranges between 750,000 to 1,500,000 gallons of water during twenty-four hours. At this station it is expected that water drawn from a well on the bank of the Ohio river, containing 35 grains of solid matter per gallon, will have the solid matter reduced to about 5 grains per gallon after treatment by the Kennicott process.

There will be in all, eighteen of these Kennicott water purifying plants installed along the road, and though the treatment of the water at each purifying plant will necessarily vary with the composition of the water used at each station, the result will be to deliver to the engines all over the road practically a uniform quality of water. The entire road, which is something under 200 miles long and which has the distinction of being one of the few with an engine for every mile of road, uses about three-and-a-half million gallons every twenty-four hours, and bearing this in mind, it is easy to understand the great value a uniform quality of water must be to a road so situated. The P. & L. E. people are fully alive to the possibilities of the situation and intend to profit by the achievements of modern chemical science.

It is said that hard scale $\frac{3}{16}$ inch thick formed upon a flue by the use of raw or untreated water, will disappear in probably a month after the treated water has been continuously introduced into the boiler. There is, however, a soft sludge which forms in all boilers using treated water, most of which sinks to the bottom and which, though it does not harden, will cause foaming if allowed to accumulate, while in any case flues, crown sheet, water legs and barrel will be free from scale or hard deposit. The sludge is not entirely removed in any case, as it would not be safe to take it all out, for an absolutely pure water would tend to pit the boiler. The washing out of boilers using treated water thus resolves itself into the much more simple process usually known in round houses as "changing the water."

To meet this state of affairs, a plant will be put in operation at McKees Rocks, after the water softening plants have been installed and are in full operation. In order to blow out very nearly all of this "sludge" the water in the boiler must be run off before fresh water is introduced, and the method to be employed for this purpose may be summarized something as follows:

An engine under about 125 lbs. steam pressure will be blown off into a hot well, the heat of which will be utilized to warm fresh water presently to be introduced into the boiler. When the boiler is quite empty the outlet will be shut off and hot water will be pumped in through the second connection of the Y-pipe, attached to the blow-off cock and against whatever pressure of steam may remain after the "sludge" water has been blown out. When the boiler has been filled with fresh hot water a total steam pressure of about 70 lbs. will be present in the boiler, and with a banked fire drawn over the grate and fresh coal applied, the blower may be used at once, and the effects due to the alteration of temperature on sheets be thus reduced to a minimum. The total time for "washing out" by this method will be about 45 minutes, which is a great improvement over the most expeditious methods now in vogue.

The Pittsburgh Shops of the American Locomotive Company have a way of providing for the boring out and bushing of cylinders, when such becomes necessary, without requiring the making of other changes. When it is desired to be able to do this work, they make the counter bore of the cylinders $\frac{5}{8}$ ins. on a side, and both cylinder covers when designed to suit this counter bore, do not need to be altered after a new bushing has been put in. The slight extra clearance involved in this method is thought to be fully offset by the advantage thus gained.

A thousand things are hidden still,
And not a hundred known.

—*Tennyson.*

General Correspondence.

Davis H. Dotterer.

Davis H. Dotterer was a builder of furnace and rolling mill machinery, and also of locomotives, away back between 1835 and 1850, when the number of establishments engaged in such work in this country could have nearly been counted on a man's fingers; that entitles his name to a place on the roll of the early American mechanics.

Mr. Dotterer was the senior partner of the firm of Dotterer & Darling, whose shops were in Reading, Pa., between 1835 and 1840. The firm built several engines for the Philadelphia & Columbia Railroad. Mr. Dotterer was the mechanical head of the firm, and designed these engines. A feature, and peculiarity of one or two of them, was "water grate bars"; not put in to protect the bars, but as a heater for the feed water between the pump and boiler. They were put in in form of a square coil, but did not prove a success, as iron piping in those days was of a crude character. Neither did they amount to much as heaters. To quote Mr. D., "the fresh air through and over them kept the grates nice and cool." Notwithstanding the failure of the device, it was, no doubt, the first attempt to use water grates on a locomotive in this country, if not anywhere.

Later on the firm built some locomotives for the Philadelphia & Reading Railroad Co., weight about 15 tons, 15x20 in cylinders, wheels 4 ft. 6 in., 4 wheels connected and 4 wheel truck. They were very efficient engines and well built. One of these engines, the Monocacy, was connected with endless chains on inside drivers instead of side rods. Lost motion soon caused a change from the chain connection to side rods.

The firm built the engines and machinery for the Scranton Coal & Iron Company's rolling mill and furnace.

When the "Leggets Gap" Railroad was rehabilitated and called the Lackawanna & Western Railroad, running from Scranton to the Great Bend in New York State, Mr. Dotterer was called to the superintendency and master mechanicship of the company. He bought a small English engine, the "Spitfire," from the Philadelphia & Reading Co. to haul the iron and material to build the road. The writer, with his brother, took the engine via Pennsylvania Canal to Pittston, and thence to Scranton via the Pennsylvania Coal Co.'s road to Scranton in the early spring of 1851.

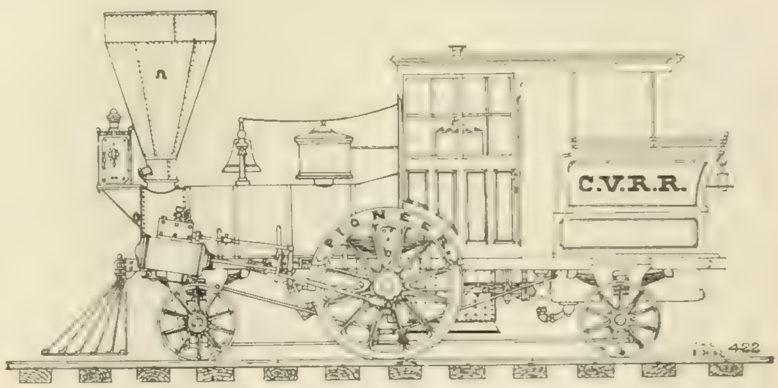
One day the writer was sitting in the rolling mill with Mr. Dotterer waiting for the loading of rails, when he called my attention to the hard exhaust of the 90 horse stationary engine that drove the rail train of rolls, and said, "Rauch, there is a great loss in the high pressure engine. I don't see anything to prevent the exhaust steam from being passed into another cylinder of twice, or more, the size of the high pressure, and to get 180 horse power from the steam that now yields only 90." He took out his memorandum book and made a rough sketch of a tandem compound engine.

Later on when the new engines began to arrive, they had enormous whistles that were deafening. Mr. D. showed me a sketch of a whistle bowl somewhat similar to the present siren.

Thus, in 1851, Mr. Dotterer had the idea of compound engines and musical whistle, which other men in later years perfected and brought into use.

New York, August, 1903.

E. J. Rauch.



ONE OF SETH WILMARTH'S SHANGHAIS

An Old Seth Wilmarth Locomotive.

The accompanying drawing shows a locomotive still in running order, which was built in 1851 by Seth Wilmarth at South Boston, Mass., for the Cumberland Valley Railroad Co.

The Pioneer was used for a number of years in the passenger service of that company, and according to Mr. J. L. Lawrence, the general foreman of the Motive Power Department, has never been changed or remodeled.

On October 22, 1901, Mr. Lawrence took it under steam from Chambersburgh to Carlisle, on the occasion of a centennial gathering at the latter place, but did not keep it under steam during the ceremonies on account of a leaking flue.

The engine, it will be observed, is fitted with link motion, thus showing this form of valve gear to have been used by the Cumberland Valley Railroad five years previous to its introduction on the great system to which the line is now very closely allied.

The engine and tender are contained on one continuous frame.

A peculiar form of steam chest is used, in which the cover is on the side.

The main rods, and in fact all of the parts, are very light.

Principal sizes of this engine are as follows: Cylinders, 9x14 ins.; drivers, 54 ins. diameter; weight of engine, 26,000 lbs.

Another engine very similar to the Pioneer in size and shape of parts, but having a car rigidly attached to it, stands on the same track with the Pioneer. On this engine a badge-plate on the smoke arch names the Cumberland Valley Railroad shops as builder. The similarity of appearance to the Pioneer would indicate that this latter engine is also a Wilmarth, remodeled in the Cumberland Valley Railroad shops.

It would be well if this engine, "Pioneer," could be preserved in some museum or public building, as it is undoubtedly the only Wilmarth engine in existence.

Little seems to be known now of the locomotive works of Seth Wilmarth except that they were located at South Boston, Mass., and that many of his engines were closely on lines of those built by Hinckley.

The Boston & Albany Railroad, or one of the roads later combined in that system, owned one named "Fury," built in 1849, of which a photograph is still, or was, at least in 1897, in existence. Three were built for the Pennsylvania Railroad in 1852-3, and continued in service until 1870. All these had hook motion and variable cut-off. Others were built for the C. V. R. R. beside the Pioneer, but correct information as to these cannot be obtained.

It might be interesting if those yet

living who were familiar with Seth Wilmarth and his shops and their engines could place such knowledge on record through the columns of RAILWAY AND LOCOMOTIVE ENGINEERING. The latest date to which the writer can trace work from these shops is 1853.

C. H. CARUTHERS.

Yeadon, Pa.

We should be very glad indeed if old railroad men would tell what they know about very old locomotives that have escaped the scrap heap. There is a good deal of valuable historical data among old men who ought to impart it before they pass away.—Ed.

Circus Trains.

Just as I write there comes news of a serious disaster on one of the western roads, due to the collision of two sections of a circus train. At this time I do not have the information whether the accident was caused by the neglect of the engineer to apply his brakes, poor condition of the brakes, or failure to properly flag. The report states, however, that the accident was caused by "failure of the air brakes to operate," an excuse exceedingly antiquated and flimsy.

Circus trains are usually the most valuable trains in the freight class which a railroad company is called upon to transport. The movement of such trains is hazardous, needs unusual care and attention, and pays the railroad company none too well for its transport. The large collection of valuable wild animals makes a collision or serious accident of great consequence and expense.

The circus people own their own cars, and very seldom take the same interest in the condition of the equipment as do railroad companies in theirs. The result is that the equipment is very seldom up to the M. C. B. standards and requirements, and are not always in first class condition. Usually considerable difficulty is experienced in obtaining permission for the railroad company to make the necessary repairs on circus cars, and to get their pay for the same. Again, nearly every circus train passing over a railroad to-day is accompanied by a corps of railroad officials to insure the success of the transport of the train, those accompanying the train usually being the train master, the general air brake inspector, a car repairer or two, and frequently a railroad detective, and the superintendent of the division.

Circus cars are, as a rule, notorious for the bad condition of their air brakes. Recently a general air brake inspector on one of the large systems in this vicinity was ordered to receive a circus train of thirty-five cars at certain connecting point on the system, and to have the brakes put in a condition equal to those on the system's own cars. The result was that the train had to be held at the starting point an unusually long time to accomplish all of the necessary work. It was found necessary to clean and oil all of the triple valves on the thirty-five cars. The foundation brake gear was so badly patched up that it was found necessary to replace a score of rods and levers. One-half dozen antiquated, wooden brake beams and four poor metal brake beams were replaced. Eight triple valves which had been cut out on account of being defective or inoperative were placed in good working condition. Ten new packing leathers were required in as many brake cylinders, and the leathers remaining in other cylinders were removed and softened up, being found in a dry and poor holding condition.

This specific case is cited to call attention to the fact that circus trains are sometimes permitted to pass in poor condition over roads. Possibly the number of brakes in working condition are sufficient to handle the train in ordinary movement, but sadly deficient if the train is called upon to make an emergency stop in close quarters. The circus people are as a rule reluctant to permit repairs to be made on their cars or on car apparatus; and even when such work is performed a great deal of difficulty is experienced in collecting the money due the railroad company for this work done. The result is that railroads sometimes run the risk of moving a poorly conditioned train, and the circus people reason that if one road can do it that all can afford to do it equally well.

Railroads cannot be too strict in forcing the circus people to either place their own cars in as good condition upon entering a system as a system itself requires its own cars to be.

AMOS JUDD.

Boston, Mass.

Early Reminiscences of Lucius and a Mule.

As I pen these lines my thoughts go back to the good old days when I was a fireman on the Central Pacific Railway in California, in the early 80's.

As I have not the engineer's permission to use his name in connection with this story I am going to tell, it will suffice when I say that it was not Bill Kretley, nicknamed Stuttering Bill by the railroad boys, who was the hero in this case of mine. As Stuttering Bill worked on the South Pacific coast for a few months only, many of the old timers on the Central Pacific, where the accident occurred, never knew of Bill, but they had good reason to remember Lucius G., as I am going to call him.

Lucius, like Bill, had an impediment in his speech and stammered badly when there was anything to arouse his temper. He was considered one of our crack throttle pullers and hauled the fast express. Thirty miles an hour was the limit of speed allowed and considered fast time. Lucius, for some reason, had been delayed on one of his trips and was attempting to regain some of the lost time, so as to make connection with the Ferry. When within a short distance of his terminus he espied an old decrepid mule contently browsing on the track ahead of him. The company having been assessed heavy damages a number of times for the killing of stock, specified, in one of its rules, that every effort was to be made to prevent the killing of stock, and with this Lucius complied. He whistled, applied the air brake and came to a stop. His muleship left the track, only to return each time that Lucius got his train in motion again, and disputed the right of way with him.

Thoroughly exasperated at the turn of affairs Lucius gave vent to his pent up anger and remarked: "Da—da—damn yer, ye have ch—ch—changed yer mind have ye, wu—wu—wull so have I." Putting on a full head of steam and lever at full stroke he sent the mule to the happy hunting grounds.

Now, the company's stock report asked a multitude of questions, which Lucius could not truthfully answer, and he lost his breath when the story leaked out. But Lucius was of a thrifty nature and went to fruit raising in the interior. Fortune smiled on him and the ranchers in his vicinity built a line to connect with the Central Pacific, so as to better market their crops. Lucius was put in charge of the engine. During the day his time was spent on the farm and in the evening he would run in his train to connect with the Central Pacific Overland express. The little line was finally absorbed and the Central Pacific once more had Lucius in its employ.

Lucius was sent on another division and I fired for him one week on wheat specials. While coaling up the engine with the train crew one day, one of the brakemen volunteered to tell the story of Lucius and the mule. Lucius was a patient listener, boiling over with rage, and I, anxious to see the outcome, did not put the brakeman onto his quiet listener. But I hadn't long to wait. Mr. *Brakeman* was making a bee line up the track with Lucius after him, and the brakeman, now dead, never forgave me for not telling him that the hero was listening to his own experience. Lucius through the kind offices of the engineers' brotherhood, was shortly reinstated to his former position, and when I last saw him, several years ago, he was still a throttle puller on the flyer and making sixty miles an hour. He must have ch—changed his mind, for he was keeping out of trouble and proving himself a very successful engineer.

J. A. B.

Broken Staybolts.

Your article is timely, I have observed as many broken staybolts, as you say, taken from locomotives.

Yes, drilled holes are not always in the center, they weaken the bolt, and fill up with grease and dirt, preventing warning, and often breaking where the drilling stops.

Plugging the hole is reckless of consequences. Life and property is at stake, and those who hide defects by plugging the holes should be held responsible, for those who do such things know that they are inflicting risks of disaster on the unsuspicious.

Broken staybolts, like a disease which has become epidemic, are very prevalent now, more so than usual, if one may judge from the discussion of the Master Boiler Makers' Association, at their recent convention, where they diagnosed, and imagined many causes, but proposed no definite cures, their diagnosing and prescribing were indeterminate, with tendency to empirical theories.

Yes, "when the inevitable explosion happens, men will hold up their hands and say that the cause of the accident was a mystery." Just like a coroner's inquest, when a train runs down a precipice. Why? Experts are called before the jury to tell why? The experts decide, as they have often done, that it was because of "spreading of the rails." Why should the rails spread?

The experts may answer: Because they find the iron in the spikes or bolts crystallized and the momentum of the train would break them.

What would cause the iron to crystallize? The experts might answer: That it might have been crystallized in the manufacture of the iron before it was made into bolts or spikes; or that it might have been caused by vibration; and in the case of staybolts, they might say it might have been caused by burning; or by unequal expansion and contraction.

True, "with hollow bolts, plugging would be out of the question," and with hollow bolts, the expansion and contraction would be reduced to the minimum, for with air flowing through them their maximum temperature would not be much, if any more than the temperature of the water or steam in the water space, they could not be burned, nor could their molecular structure be affected by the expansion or contraction of the sheet against them, for the air in the center of the bolts relieves the pressure on the walls of the hollow bolts.

Air and water are effective protectors of the bolt from burning, the hollow staybolts enjoy both, the solid has only the water, and where it passes through the inside sheet, the solid staybolt and the sheet are least protected, cracking and burning are probable, whereas, the hollow bolt is protected throughout its entire length; the hollow bolt receives the expansion of the sheet without the resistance at expansion to the sheet, which the solid bolts present, with risk of crystallizing by pressure on the molecular structure, the hollow bolt has its relief inward on the elastic air passing through it, and the elasticity is most where it is most needed, at the inner end of the bolt, the air expanding to about a three-fold volume between the outer and the inner end of the bolt, with heat.

What may be asked is the effect of burning? The answer may be given specifically from a technical journal with respect to tests?

A plate of steel showed when tested, results as follows:

Tensile strength..............	50,350 lbs.
Elongation....................	31.5%

After service in the fire box, a strip of the same plate was cut out and tested, with results as follows:

Tensile strength..............	30,720 lbs.
Elongation....................	5%

It was found to be burnt, and the fracture showed crystallization.

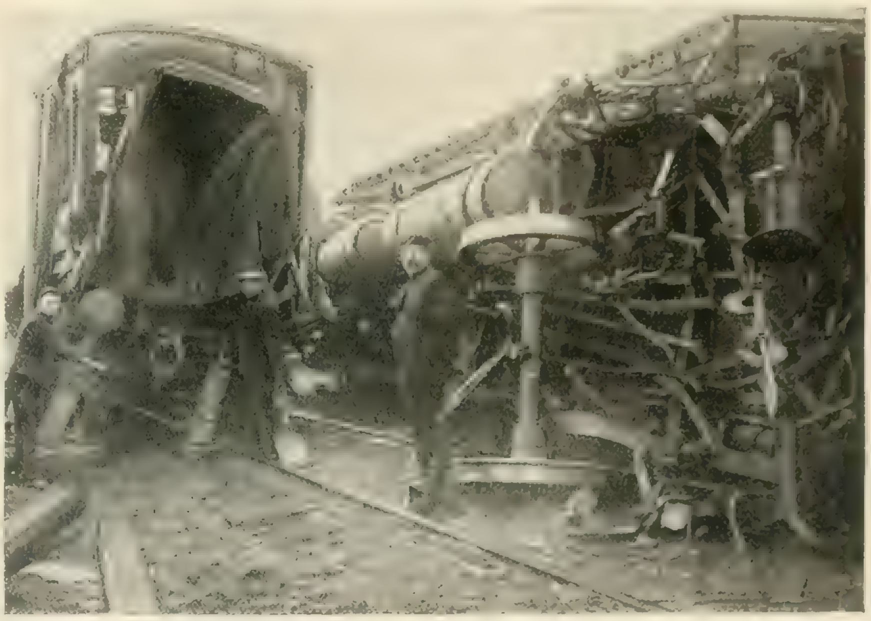
Much of the staybolt trouble of to-day, a writer in *Motive Power* says, "can be traced to the fire, as those who are familiar with the fatal blue heat are aware of the fact that when one of the ends of the staybolts is heated the fatal blue heat must appear somewhere in the total lengths of the bolts, hence very little expansion is necessary to break such a bolt."

That alleged cause of breakage which may be charged to solid staybolts has no place in the service of the hollow staybolts, because the air passing through them, and the temperature of the water or steam in the water spaces are absolute preventatives to the burning of the hollow staybolt, nor can expansion and contraction, in the same degree as with solid staybolts, tend by vibrations from such action, to crystalize the hollow staybolts.

That is not mere theory, it is founded on demonstration in various ways, and in a report from a railway upon a boiler in which the hollow staybolts were continuously in service for over six years, there is nothing said about burning, nor about crystalization.

With the quality what it always should be, in hollow staybolts, they will endure more, and outlast any solid staybolt on the market. JOHN LIVINGSTONE.

Montreal, Can.



A GERMAN COUP.

Treatment of Train Men in Mexico.

From time to time items have appeared in your paper commenting on an alleged state of affairs in Mexico than which Americans working on the railroads there are frequently subjected to unjust and even brutal treatment by the authorities in case they (the employes) chance to be connected with an accident, and giving the impression that even when they are in no wise directly responsible for the trouble they are liable to be thrown into prison and left there indefinitely without recourse.

I was in Mexico a few weeks ago. One afternoon a freight ahead was derailed and during the wait that resulted I had a little talk with our engineer on this subject. I began it by remarking that I supposed some poor fellow countrymen of ours would either have to promptly take to the woods or lanquish for this spill, judging from what I had seen in our papers, and he laughed at me. He said, in effect, that most of that sort of thing is tommy-rot, as every railroad

man in Mexico knows. That a conscientious trainman there has no more to fear than in the United States, and that the tales to the contrary originate mostly with sore-heads who, either because of incapacity or for some other good reason, have found the country too warm for them and who then endeavor to justify their leaving by relating fanciful stories of persecution. As I remember it, he said that when a trainman appears to have been grossly negligent, especially in cases involving casualties, then he must answer in the courts, and not otherwise, and no one can well take exception to that.

Not being especially interested I did not investigate further, but this engineer was a big, bluff, jovial man, having apparently no axe to grind, and his assertions convinced me, at least, that Mexico has been slandered more or less.

RALPH B. BOWMAN.

The Staff System of Train Control.

In looking over some of your back numbers for some information I was in want of, my attention was arrested in the issue of April, 1902, by an article bearing the above heading, and it struck me that the system of train control you there refer to as being in use upon a certain portion of the Cincinnati, New Orleans & Texas Pacific Railroad must be very much like a system which has been in use upon all the single track of the Great North of Scotland Railroad for twelve or fourteen years, and known as Tyers Electric Tablet System. The only point of difference which I can see is that under the system which you describe a train can be put into a siding between two stations and the staff instruments at both ends unlocked so as to permit of another train going through the section; whereas with the tablet system I am not aware of any provision being made for this. There is no doubt this is a decided advantage where the block sections are long, but where, as with us, they are not more than five or six miles in length it is hardly worth while making provision for.

The object of the tablet system is to provide a quick means of dealing with trains and at the same time prevent more than one being between two tablet stations at one time, and, when no train is in the section, to admit of one being started from either end as occasion requires. In order to accomplish this each division is broken up into sections, the ends of which are electrically connected and provided with loop lines where two trains can meet and pass one another. Each terminal tablet station is provided with one, and each intermediate tablet station with two tablet instruments. Each pair of instruments are supplied with thirty tablets, and each instrument can hold all the thirty, but this is simply to allow sufficient margin in working before having to transfer tablets from one end of the section to the other should this become necessary on account of a greater number of trains running in one direction than the other. Suppose the stations to be named A B C D and so on, and the signalman at A wishes to despatch a train he would give the "Is line clear?" Signal to B. If the line is clear to B the signalman there will acknowledge this signal and give permission to the signalman at A to remove a tablet from his instrument. The signalman at A knows when he has received this permission by seeing a magnetic needle on the front of his instrument deflected to zero and he then turns a commutator to the left, draws out a slide containing the tablet and gives one beat on a bell to B which causes the indicators on both instruments to indicate "tablet out" for up or down trains as the case may be. He then pulls off his semaphore signals and hands the tablet to the engine driver.

When the train has entered the Section A sends the "Train entered Section" signal to B, on receipt of which B will go to his instrument for the opposite section and send the "Is line clear?" signal to C, and so on.

The switches for sidings situated between two tablet stations are locked for the main line and the tablet for the section in which they are located forms the key for them so that they cannot be moved unless the engine driver who is in possession of the section at the time gives up the tablet for that purpose. The locking frames for these sidings have two levers and in order to get the switches shifted the tablet is placed in a recess in the frame, which allows the lever for locking the switches to be pulled over, but when this is done the tablet is locked in and cannot be withdrawn until the switches are set for the main line and the locking lever put back to secure them, so that there is no possibility of taking away the tablet and leaving the switches set except for the main line.

When this system of train control gets interrupted in any way such as the instruments being damaged by a severe thunder storm or the wires being broken, we resort to what is known as Red Cap pilot working, but as it is practically the same as the staff and ticket system which you mention in your article I will not deal with it here.

In conjunction with the tablet system we use an apparatus for exchanging tablets. This apparatus was an invention of the late Mr. McWilliam McKay, who was for many years shop foreman with the G. N. S. Railway at Kittybrewster, and I am sure you will agree that it does its work very well when by its use we can exchange tablets with trains running over 60 miles per hour.

This apparatus consists of a cast iron pillar erected in a suitable position on the left hand side of the line near the signal cabin. A sliding lever is placed on the top of the pillar, and affixed to the lever is a cross arm with a spring catcher at one end and a delivery spring at the other. A corresponding apparatus is fixed on the left side of the engine, but the position of the spring catcher and delivery spring is reversed. When tablets are to be exchanged they are enclosed in leather pouches. The signalman places the one to be picked up in the delivery spring of the ground apparatus, and the driver places the one to be left in the delivery spring of the apparatus on the engine. The sliding levers are then pushed out as far as they will go and firmly held in that position until the exchange has been effected.

I have not been able to make this quite so clear as I should like to have done, but from the enclosed sketches and other descriptive matter you will perhaps be able to follow it.

WILLIAM LEITH.

Aberdeen, Scotland.

A Scientific Liar.

BY SHANDY MAGUIRE.

Jim Kelly and Jack Stanley were the engineer and fireman of engine "63" on the P. E. & W. road. As their names indicate, they were offsprings of the Ould Sod, Kelly being a Corkonian and Stanley from Kerry, two adjoining counties. They were what Roadmaster Deegan called "Two strappin' fine fellows," because when he had them on work train they attended to business. They never could hitch between themselves within the confines of the cab. They were continually on the chew; Kelly standing on the time-honored prerogatives of an engineer, and Stanley also thinking he had something to say. To their credit be it said that there were no tales told out of school; what took place on each trip being kept as secret as if each life was depending on secrecy.

Running on time one evening on the "pick up" a sudden jar and a deafening rattling caused Kelly to apply the emergency. A first glance underneath would convince a skeptic that "63" was somewhat dilapidated.

"She's there, but not the whole of her," said Stanley.

"I see she is, what's left," said Kelly with a scowl.

By this time several passengers had picked themselves up from between the seats and very considerately had arrived at the engine to offer suggestions on what to do. The conductor, watch in hand, said to Kelly: "How long is it goin' to take you to get out of here?"

"About half an hour if everything works all right."

In an aside, away from Kelly, but in

the hearing of a bunch of passengers, said he: "Nothin' works all right with you. I'll have you stopped from haulin me."

The passengers smiled, and one of them, a yokel from Tarburg, on his way to Cluxton for a couple of yearlings, looked with concentrated admiration at his mighty ribs. Kelly found a hell's-hurrah underneath. The two eccentric blades and one lifter bent on one side; the driver-brake rigging, the ash pan, one sand pipe, one brake cylinder and a cross brace all tangled up together, what was left of them.

"Hand me the hammer, chisel and monkey wrench, Jack," said Kelly from underneath.

"There's no Stanley here," said a passenger.

About this time Jack showed up and the spectators were expecting a set-to between Cork and Kerry. "Where was you and Stanley at such a time as this when you was needed so badly by me?"

"Oh, just eatin' a sandwich, and toppin' off with a swig of Adam's ale."

The look on Kelly's face indicated struggling of a severe mental order. Kelly knew that his best plan was to conciliate Jack, in view of the investigation to take place so as to locate the cause of the engine failure, and he only said: "Come here and give me a hand.'

"I'll have to give you two, Jim, and you'll need two heads to tell to the old man's satisfaction how it happened, when you are called up for trial."

In about 25 minutes the engine was ready to go home on one side. There was a terribly glum look upon Kelly's face all the way in, and Stanley did not help to smooth his ruffled feelings in the least. "Say, Jim, if the little widow with the coaxin' eyes and tawny locks could get a glimpse of you now she'd not be quite so conscious that you were the handsomest man that ever sat in a cab, as she said to Jack McCabe's wife after you left her last pay night.

"Jim, I'm in no humor to listen to any of your ould guff to-night. Give me a rest."

"Be gob, me bucko, if you only meditated quarter as much on tossing up the rascalities of your heart, to pour them into Father O'Leary's ear in a penitential mood, when at his knee, as you are now thinking what you'll tell Dawson caused the failure, the church would soon hear from the college of cardinals that another saint, by the name of Jim Kelly, was added to its calendar."

"Say, Jack, let up on me to-night; I am in no humor for your fun."

"If you had looked her over as she ought to have been, may be you'd have found a cotter or a pin gone out of the forward brake head by the looks of things, which let them down. You trust too much to a perfunctory inspection by a man getting one fifty a day, who doesn't care a tinker's dam if school keeps or not.

"I'll tell that I inspected her good, considering the time I had to turn around in."

"Of course you will, and you'll flounder around from lie to lie until you'll get lost in a fog of blunderin' blather. You don't know how to 'lie truthfully,' Jim, as your townies, the Corkonians, would say, so you'd better tell Dawson as little as you possibly can, because he doesn't take much stock in your guff anyway, ever since the time you told him the lie of going to see your sick mother, when he let you lay off, and learned that you went to the hop fields with old Peg Thorpe and her chums instead."

LEHIGH VALLEY EXPRESS TRAIN AT 60 MILES AN HOUR.
Photographed by Lynn Merrill, Utica, N. Y

"Jack, I know he is after me, and only waitin' for a chance to let me out."

"And when you know it why don't you look out for your job? You have one of the best runs in the country. You leave your home every morning at 7.30, you are back at 7 in the evening, and have 4 hours and 37 minutes of a lay over in Cardiff, and if you cared anything about the splendid position you'd take six dollars and eighty-seven cents a day out of every day in the month, and only from home for one meal, you'd attend more to looking after the engine you make it on than you do."

"What good does it do you to be so gifted with gab as you are to-night?"

"I'm sick of the way you've been carrying sail for some time. For the sake of your decent wife and your noble old mother and the county where your father first drew the breath of life, break away from the vacations you take between runs, and attend to your duties closer than you do."

"Well, if the old man does not get on to me this time, I'll promise you that I'll take your advice."

"You do?"

"Yes."

"Gimme yer hand upon it."

They shook hands warmly, Stanley saying: "This reminds me of the loyalty of our daddies. When the fight would be going against the Corkies, and they'd turn tail, when the Kerry boys would be found, coming to the rescue, the cry was 'Come back Cork, Kerry is coming!' I'll get you out of this scrape, or die trying. When we are up for investigation, all you have to say is when you were rounding Rupert Curve you saw something on the track, between the rails, but you being on the outside, you could not tell what it was or check speed until you ran over it. I'll do the rest."

Next morning the train master, representing the transportion department, the master mechanic and a stenographer were seated in the shop office. There was absolute silence for a few moments after Kelly and Stanley entered and took seats, until Stanley broke it by saying: "Begob, I often heard tell of a Quaker meetin', but never was at one before."

"It will not long remain one where you are, Mr. Stanley," said the train master, who had no love for him. "Mr. Forsyth," was Jack's reply, "you are noted for doin' a lot of talkin' with your mouth yourself."

The stenographer being ready, the

talking was turned into another channel by M. M. Dawson.

"Mr. Kelly," said he, "you are reported on yesterday's work sheet 37 minutes late, owing to a breakdown caused by poor inspection. Please give us your explanation." The sarcastic force laid on the please was all Kelly required to stiffen his backbone; besides, he had faith in Stanley, so he spoke up saying he was rounding the sharp curve, he being on the outside, and saw something ahead, but was over it before he could do anything. "What the result was is explained on my report, which I see you have in your hand."

A supercilious sneer was on the face of the M. M., who again led, looking for an opening.

"Are you sure you saw an obstruction in front of you?"

"Yes, sir, just as sure as I see you"—without the quiver of a muscle.

"Did you go back to find out what it was?"

"No, sir, I was in too much of a hurry to get out of the way of the limited, and get in with my passengers."

"You did not make very good time taking down your engine."

"You haven't a man could do it quicker, considerin' the kit of tools you furnish."

That was a solar plexus thump from Jim and he was dropped. Stanley was now taken in hand.

"Mr. Stanley, what do you know about this?"

"I know that I saw something right ahead of us, but not soon enough to notify Kelly, as I was attendin' to my fire. I helped him to take down the engine after I notified Tom McCarthy that he'd better go back to the curve and pick up one of his brace blocks, which are spiked on the outside of the rails to keep them from spreading. Before we got started he went back, but I did not see him again until I was coming up here. He gave me this—Stanley went outside of the door and fetched in an 8-inch coil spring, looking as if it had been through a fusilade, saying 'there's yer damned packin' block for ye, the thrack is all right.'"

While Jack was talking Kelly watched him with the same anxiety of vision a culprit watches the foreman of a jury after his return to court to ascertain if he was a dead man or not, his face brightening as Jack talked, the crests of the M. M. and the T. M. dropping noticeably as the talk went on, for both of them were after Jim, and very anxious to erase his name from the pay rolls. The investigation was continued but a few moments longer, as the witness for the defence could not be shaken, so the two executioners lost their victim.

When Kelly and Stanley were well out of hearing Kelly's exultation showed itself almost to the point of hugging Jack, but he warmly said, "Jack, I feel like kissin' you." "You'd better get over your appetite for kissin'," he replied, "particularly the tawny-haired widow, or you may sup sorrow without a spoon next time ould Dawson gets a grip on you."

"Well, yer a trump anyway. I never heard so accomplished a liar. How did you do it? And where did the spring come from?"

"I'll tell you, but don't forget your promise. Be square and manly with your family and the company, and as far as I am concerned, mum's the word. Here is the way I saved you: Some time ago I asked Joe Wheeler, the car foreman, for an 8-inch coil spring to make us a handy push bar. I was waitin' my chance to get the blacksmith at it. While the royal Poo Bah of a ticket puncher and the passengers were comin' up on one side of the train to see what was the matter, I was scootin' out the other side to place the spring where it would do the most good. I would have gone back to pick it up, so as that no one would run over it, but I met Section Boss McCarthy and told him it was a cast iron brace block that binds the outside of the curve, knowing he'd go back to save his neck, and fetch it in. I left it handy, so as I could produce it in court at the proper time. That is where I was, instead of eatin' the sandwich."

"Suppose they make a search for the car that lost the spring?"

"They might as well look for a needle in a bundle of straw. The last train of 95 cars left the division at the junction for the P. & D. an hour before. They'll not follow it up."

"Well, Jack, I thank you. All I can say is that you are a scientific liar, and a first class preacher. You gave me a thoroughly moral lecturing all the way in last night, and this morning exemplified to my astonishment how you can make black appear white."

"Yes, I did, but the end justified the means. If I saved you from the divorce court and kept a happy home for you, besides your job, by hurting nobody, I am willing to stand up for punishment when the sheep and goats will be gathered together, and I will not get it very bad for what I said to-day. You look out for your promise. If there is any more monkeying between you and the widow you'll hear from me again."

J. R Slack, Supt. Motive Power. 4-6-0 FOR DELAWARE & HUDSON. American Locomotive Co., Builders.

Ten-Wheeler for the D. & H.

The Schenectady Works of the American Locomotive Company have recently supplied the Delaware & Hudson with some culm burning engines of the ten-wheel type. These engines are simple, with 21x26 ins. cylinders and 72 ins. driving wheels. All the wheels are flanged. The cab is placed over the center of the boiler and this makes the engine a "Mother Hubard" in railroad parlance. The valve gear is indirect, the eccentrics being on the main driving axle and an extension bar curved slightly over the forward axle reaches the rocker in the usual way. The pedestal braces are bolts with thimbles between the jaws with cross-brace joining frames forward of the leading axle, and with cross-frame braces behind the main and trailing wheels. The valves are American balance slide valves, and are used on all the engines of

this order except two, upon which the Richardson Balance valves are tried.

The boiler is a straight top one, with a Wooten fire box. It is 63 ins. in diameter at the smoke box end. The total heating surface 2,663.72 sq. ft., of which the 308 fifteen-foot tubes contribute 2405.5 sq. ft. The grate area is 84.85 sq. ft. The fire box has one wide door, and the staying between the crown and roof sheets is radial. There is a cab roof overhanging the deck of the tender, which protects the fireman when at work, and the grate slopes lightly forward.

The total weight of this engine is about 175,000 lbs., of which 131,500 lbs. rest upon the drivers. The tender is carried on a steel channel frame, and the tank has a water bottom. It has a water capacity of 6,500 U. S. gallons, and is designed to carry 8 tons of coal. The engine is an example of good serviceable medium passenger power in which excessive weight has not been desired. A few of the leading dimensions are appended for reference:

General Dimensions—Fuel, fine anthracite coal; weight in working order, 175,000 lbs.; weight on drivers, 131,500 lbs. wgt. eng. and tend. in working order, 202,250 lbs ; wheel base, driving, 16 ft.; wheel base total, 26 ft 4 ins.; wheel base, total, engine and tender, 53 ft. 7½ ins.

Cylinders—Dia., 21 x 26 ins.; size of steam ports, 18 x 1⅜ ins ; size of exhaust ports, 18 x 3 ins.; size of bridges, 1⅜ ins.

Valves—Greatest trav. of slide valves, 5½ ins.; outside lap of slide valves. 1 in ; inside lap of slide valves, 0 in ; lead of valves in full gear, 1/16 in.

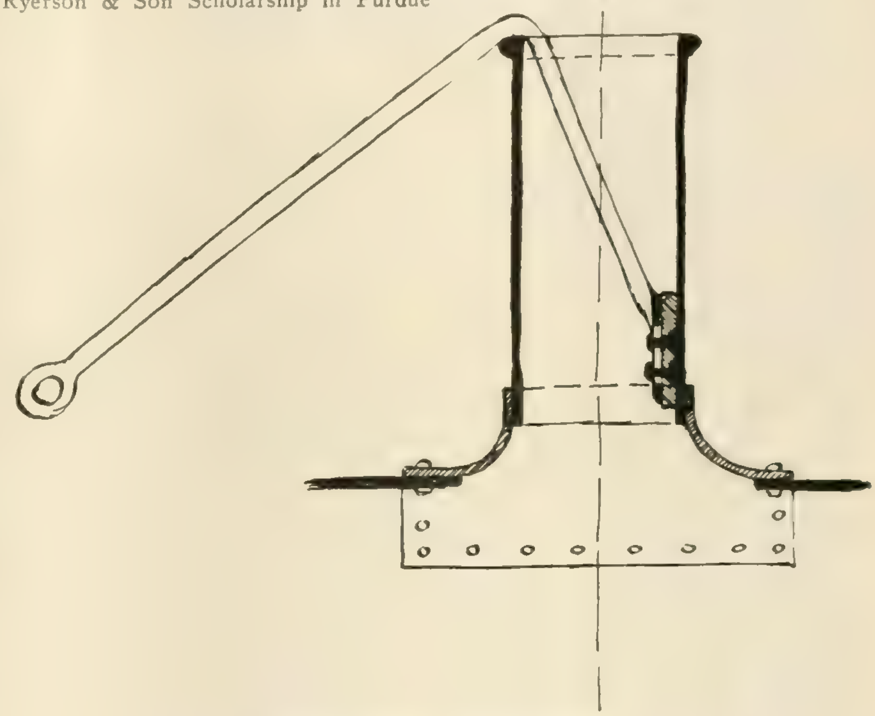
Wheels—Dia. of driving wheels outside of tires, 72 ins.; dia of engine truck wheels, 33 in.

Boiler—Style, Wootin type; working pressure, 200 lbs.; thickness of plates in barrel and outside of fire box, 5/8, 21/32, 1/2, 3/4 in., fire box, lgt, 110 7/8 ins.; fire box, width, 102 ins.; fire box, depth, front, 64 ins.; back, 42 ins ; fire box plates, thickness, sides, ⅜ in ; back, ⅜ in.; crown, ⅜ in.; tube sheet, ½ in.; fire box, water space, 3½ ins front; 3 in. sides; 3½ in. back; fire box, crown staying, radial; tubes, num., 308; heating sur., tubes, 2,405.5 sq. ft.; heating sur., water tubes, 78.54 sq. ft.; heating sur., fire box, 179.68 sq ft.; heating sur., total, 2,663.72 sq. ft.; grate sur., 84.85 sq. ft. grate, style, water grate.

Tender—Weight, empty, 47,100 lbs.; wheel base, 18 ft. 5 ins.; tender frame, 10 ins. steel channels.

Simple Shop Crane.

Probably the simplest style of shop crane for use on the front end of locomotives is to be found in the St. Louis shops of the Missouri Pacific Railroad. The crane is one of those handy shop appliances which makes use of the smoke stack as its excuse for being. The crane, as our illustration shows, is simply a heavy bar of round iron, perhaps 1½ or 2 ins. in diameter, with an eye at one end to take the hook of a small block and tackle, and the other end is flattened out and riveted to a "foot" which lies up snugly against the curved inside of the stack while the "crane" end of the device hangs over the stack at what may be described as the "appropriate angle." This handy and simple crane has been in use for some time and its merits are well attested in the Missouri Pacific shops. The method here adopted, does away with the strut which usually stands between outside of stack and eye for block and tackle hook. The use of heavy cast iron stacks makes this form of crane quite satisfactory and it has been known to work all right even with the "foot" broken off, under such circumstances. With the lighter form of stack the "foot" is however very necessary in order to distribute the thrust of lower end of the inside bar over a certain area, but in either case it makes a very useful, simple and easily-made shop device.


HANDY SMOKE STACK CRANE.

Ryerson Scholarships.

The Executive Committee of the American Railway Master Mechanics' Association has awarded the Joseph T. Ryerson & Son Scholarship in Purdue University to Arthur B. Marsh, of Boston, Mass. The committee, consisting of W. H. Lewis, of Roanoke, Va., president of the association, Peter H. Peck, of Chicago, vice-president, and Joseph W. Taylor, also of Chicago, secretary, held a meeting at Purdue and reviewed the results of the examination of all candidates as presented by the university authority. It was found that seventeen candidates had submitted to the prescribed examination. Mr. Marsh was certified to by the university authority as having obtained the best results in his examination.

The percentage of merit displayed by the competitors in this examination was remarkably high. It is a great pity that no scholarships are open for the unsuccessful candidates.

Changes in M. C. B. Interchange Rules.

Among the changes made in the code of car interchange rules at the last M. C. B. convention the principal are: Rules Nos. 35 to 39—Side doors lost are now considered as owners' defect. Rule No. 64—No wheels are to be applied to foreign cars if they have been cast over six years. Rule No. 69—Air brake hose applied to foreign cars must be new. Rule No. 73—Whenever cars are chained together and delivered to any other company, the receiving road shall deliver to the delivering line, an equal number of chains or issue defect card covering same. Rule No. 87—Labor charge covering the application of wheels has been changed. Rule No. 104—Several changes have been made in charge for labor. Rule No. 109—No additional labor is to be charged when replacing or renewing a coupler when one or both of the draft timbers at the same end of the car have been replaced or renewed. Rule No. 111—Prices or bodies and trucks of cars have been changed.

Some high-speed tests were made on the Jersey & Seashore Division of the Pennsylvania Railroad under very carefully conducted arrangements. It was expected that one of the heavy high-speed engines would attain a speed of 100 miles an hour with eight coaches, but 90 miles an hour was the highest speed attained. If ordinary reporters had been keeping the record any speed required would have been made.

Railway and Locomotive Engineering

A Practical Journal of Railway Motive Power and Rolling Stock.

Published monthly by

ANGUS SINCLAIR CO.,

174 Broadway, New York.

Telephone, 984 Cortlandt.
Cable Address, "Loceng," N. Y.
Glasgow, "Locauto."

Business Department:
ANGUS SINCLAIR, President.
FRED M. NELLIS, Vice President.
JAMES R. PATERSON, Secretary.

Editorial Department:
ANGUS SINCLAIR, Editor.
F. M. NELLIS, GEO. S. HODGINS, JOS. A. BAKER, Associate Editors.

Advertising Department:
Eastern Representative, S. I. CARPENTER, 170 Summer St., Boston, Mass.
Western Representative—C. J. LUCK, 1204 Monadnock Block, Chicago, Ill.

British Representative:
THE LOCOMOTIVE PUBLISHING CO., Ltd., Amen Corner, Paternoster Row, E. C., London.

Glasgow Representative:
A. F. SINCLAIR, 7 Walmer Terrace, Ibrox, Glasgow.

SUBSCRIPTION PRICE.

$2.00 per year, $1.00 for six months, postage paid to the United States, Canada and Mexico. For other parts of the world, $2.50, or ten shillings. Single copies, 20 cents. Remit by Express Money Order, Draft, Post Office Order or Registered Letter.

Mailing address can be changed as often as necessary—always give old and new address, and if you subscribed in a club, state who got it up.

Please give prompt notice when your paper fails to reach you properly.

Entered at Post Office, New York, as Second-class mail matter.

For Sale by Newsdealers Everywhere.

Counterbalancing Locomotive Driving Wheels.

We received recently from a technical contemporary, little given to discussing railroad matters, a letter from a superintendent of motive power of a prominent railroad, asking for information concerning the counterbalancing of locomotives. We were su prised that a man with the experience and standing of the official who wrote the letter, should be ignorant of the well established rules for the counterbalancing of locomotive driving wheels. On making some inquiry, however, we find that there is still considerable diversity of opinion about the proportion of conterbalance weights, which may be used to the best advantage, which moves us to outline the rules generally accepted.

There are two phases of counterbalancing that must be taken into consideration. One is having too light counterbalance weight to produce a smooth running engine, the other is having the weights too heavy, with the result that they hammer the track so badly that the rails are frequently bent by the recurring blows. These are two extremes which it is the duty of the designer or master mechanic to avoid.

When Thomas Rogers first applied counterbalance weight to the driving wheels of his engines, other locomotive builders considered it an unnecessary expense, and tried to make out that the practice was worthless; but experience with the engines soon demonstrated that the invention was a valuable one, and its detractors all fell gradually into line. But for a long time there was great diversity of opinion about what proportion of counterweight was necessary to produce the best results, and fashions in counterbalancing arose which were as diverse as the fashions in smoke stacks or in ladies' bonnets. Every locomotive builder and nearly every master mechanic had his rule for counterbalancing, and great confusion arose as to what was sound engineering practice. The famous engineering writer, D. K. Clark, had given some rules for counterbalancing as early as 1851, but they were largely empirical and were little known except among the most progressive locomotive builders. In 1878 a report on Counterbalancing Driving Wheels was submitted to the Railway Master Mechanics' Association, and the replies to a circular indicated, in an amusing manner, the progress made in the art. Among the replies were:

1. Figure a little then guess at it.

2. Counterbalance revolving and reciprocating parts, placing the weights as far from the distance as possible, and allow for distance accordingly.

3. Counterbalance by filling hollow wheels with lead. We fill five spokes and the rims between them. In small wheels we have to balance between the spokes in addition to the lead.

4. I find that in counterbalancing it becomes necessary not only to counterbalance the weight of the rods and other attachments to the rods and axles, but that there is a cushion in the cylinder and the momentum of the rods to overcome; consequently I balance weight of rods perfectly, and then add 30 per cent. of the weight counterbalanced; this gives me a perfect and steady engine.

5. Ascertain the weight of metal in arm of crank projecting beyond the diameter of hub; add to this half the weight of the connecting rod; counterbalance this by cast iron plates fitted to spokes and rim of wheel and held together by bolts, the difference of leverage and weights being taken into consideration.

6. Have experimented and found that the following plan gives a perfect balance:

Weigh the piston, cross head, main rod and side rod of one side, then put two-thirds of the whole weight balance in forward drivers, and one-third in back drivers.

7. I usually calculate the amount of counterbalance required to balance the revolving parts, such as the lower end of main rod, parallel rods, crank pins, and hubs of each wheel and assign the proper weight to each wheel. I also divide the reciprocating weights—crosshead, piston, plunger and upper end of main rod, equally between the two wheels, giving rather more to the front wheels if any difference is made, and always giving rather less than more counterbalance weight than the parts to be balanced. I then calculate the center of gravity of the counterbalance, making due allowance for its distance from the center as compared with that of the crank pin. I prefer balancing the moving parts by pouring lead into the spokes and rim, if the wheels are so made; and if not to cast the balance in between the spokes. After the wheels are down on the axles I generally raise them off the ground and allow the journals to rest on parallel strips. I then hang the proper weights on the crank pins and correct the balance to suit, if they are much out of the way. I prefer to have an excess in the front pair of wheels, and a deficiency in the back pair. I do not like the practice some builders have of making the same pattern of wheels for front and back axles and same amount of counterbalance.

These answers constituted the report and the committee did not make any recommendations. The only comment on the report was made by Mr. William Hudson, of the Rogers Locomotive Works, who said that it was a very important consideration in the arrangement of counterbalance, to know exactly what kind of work the engine was to perform.

While slow train speeds under forty miles an hour was the rule, the principal requirement for counterbalancing was to make the engine ride smoothly without oscillation, and every master mechanic engaged to adjust the weights in the driving wheels to bring about this result. If he did not, he would soon hear from the engineers. As the weight and power of locomotives kept increasing, new complications arose which proved that making an engine ride smoothly did not meet all requirements. Heavy engines with small driving wheels turning very fast were found to transmit destructive vertical shocks to track and bridges and means were necessary to soften what became known as "the hammer blow." Investigators found that the counter weights applied were in many cases too heavy. By degrees a practice became common to add weights to counterbalance the disturbing action of the one sided revolving parts, and as little as possible of the reciprocating parts. A majority of railroads fell into the habit of bal-

ancing all the reciprocating and two-thirds of the reciprocating parts divided equally among all the drivers.

Complaints having continued to be made by the engineering departments about the destructive effects of badly balanced driving wheels, a committee was appointed by the Railway Master Mechanics' Association to investigate the subject, and it was thoroughly done. This committee, of which Mr. E. M. Herr was chairman, worked for two years and made reports to the conventions in 1896 and in 1897. The rules for counterbalancing driving wheels which they recommended were:

"*First.*—Divide the total weight of the engine by 400; subtract the quotient from the weight of the reciprocating parts on one side, including the front end of the main rod.

"*Second.*—Distribute the remainder equally among all driving wheels on one side, adding to it the weight of the revolving parts for each wheel on that side. The sum for each wheel, if placed at a distance from the driving wheel center equal to the length of the crank. or a proportionately less weight at a greater distance, will be the counterbalance required."

Block Signaling on a Single Track Road.

On a double track road the object of block signals is primarily to preserve the required space-interval between trains moving in the same direction, or to put it in plain English, obeying the signal indications will prevent rear collisions.

The function of block signals on a single track road is to prevent collisions front and rear and for this purpose the signals have not only to remain at danger behind a moving train in a block but they have to show beforehand that a train is approaching.

The Cincinnati, New Orleans & Texas Pacific is a carefully operated single track road which is protected by automatic block signals and is perhaps the best example of its kind to be found in the country. Distant signals are being introduced on this line, but at present to consider the simplest form of these signals may be the more satisfactory way for the reader.

The signals for south-bound trains are placed at the right, and those for north-bound trains on the other side of the track. The beginning of a block is indicated by a small post placed about 150 feet from the signal, the object of which will be apparent later on. When we speak of the signals for a south-bound train we mean the signals which the engineer of a south-bound train would look for, in order to be informed of the condition of block ahead. On a single track road, however, the north-bound signals are also operated by a south-bound train in the vicinity, but they are then for the information of any possible north-bound engineer.

The operation of the system is briefly, a train moving south enters block C and the following signal indications give visual indication of the fact. The entrance to block C is marked by a post called the "signal station," which is 150 feet from the home signal for that block. The engineer as he approaches block C observes that the signal is "clear," if the track ahead is unoccupied, when he reaches the small post or signal station, the signal just ahead of him goes to "danger" as he passes on. The object of this as explained by the officers of the C. N. O. & T. P. is to give the engineer the opportunity to actually witness the movement of the semaphore blade, and so feel satisfied that the apparatus is in efficient working order, and also to give him that feeling of security which comes from the knowledge that the signal immediately behind his train is protecting it by showing the "danger" indication. At the same time the home signal at B is lowered, showing that the train has passed out of block B. These indications are given by what we may call the "south-bound" signals, but the entrance of this train into block C operated two signals on the "north-bound" side. It first raised the semaphore blade at E and lowered the "north-bound" one at C, which latter had already performed its duty.

The train therefore on entering block C protected itself from a following train and at the same time caused a stop signal to be instantly displayed two blocks ahead, which being a "north-bound" signal, would be looked for by an engineer of a north-bound train, if one was then on the line. This protection from "coming events" on a single track line is most important, because it pre-empts the line ahead for two blocks and says to all and sundry who are moving in the opposite direction, "Your written orders may be right or wrong, but a south-bound train is now in block C." The same kind of information is also given to the engineer of the train in block C concerning the one moving against him.

There is an interesting feature with regard to the operation of this system, and it is the fact that no sooner has a train put up the danger indication ahead of it, than by its own onward motion it tends to reduce the distance ahead at which it is protected. If on entering block C it is at once protected at E, the distance of the train from E, constantly diminishes until at a certain point, governed by circumstances, the moving train throws up another signal ahead and so maintains an advance guard all the time. The varying distance ahead at which a train is protected, owing to its own motion, is arranged so that, taking track and grade conditions into consideration, the minimum distance will at all times be adequate. "Forewarned is forearmed," and a mistake in, or a misunderstanding of, train orders would at once become apparent to the engineers of the opposing trains when they were on the road and practically beyond the reach of direct human aid, in that short but blessed interval of time, before it is just too late.

Electrically-Driven Shops.

The report of the Committee on Electrically-Driven Shops, which was presented to the Master Mechanics' Association, pointed out that the general subject of electric transmission of power was first treated in the association by a committee report in 1900. A charged wire is a more convenient agent for the transmission of power than shafting and belting. Electrically-driven tools permit the shop designer to study the movement of material in the shop and to lay out the position of each machine in the most convenient and satisfactory manner.

The most important factor in the economical movement of material is the overhead electric traveling crane and auxiliary hoists for doing rapid work with light weights. Most of the tools which have heavy material carried to them by the crane, require a good deal of power. These tools are wheel lathes, planers, boring mills, slotters, rolls, punches, shears and heavy engine lathes. The motors required for these machines are usually large enough to give a good electrical efficiency and a low cost per horse power, as compared with motors for the smaller class of machine tool. Sufficient belt power is often difficult to obtain, to work modern tools to the capacity of some of the existing tool steels. Closely related to the question of power is that of lighting, and frequently in modern plants power and light are taken from the same generators.

The problem which the shop designer has before him to-day is to decide which system of electrical power shall be used, the alternating or direct current. Where it is necessary to convey current to outlying portions of the company's property, such as passenger stations, freight sheds, etc. The alternating current is the one to use, as the cost of the copper for direct low voltage current would be practically prohibitive. On the other hand, if no long-distance transmission question enters into the calculation the power plant may be entirely used for distributing energy to a group of shop buildings situated close together, so as to make low voltage reasonably economical. If electrical speed control is desired direct current must be used for driving those tools which require speed control, but it certainly entails extra expense, and

it is necessary to demonstrate that the advantages of having it outweigh the additional cost.

With belt-driven machines, if a speed for a certain piece of work is too low, the next higher may be too high, say an increase of 40 per cent. There is always a certain amount of time and trouble required in shifting belts on cone pulleys. With electrical control, the simple movement of a convenient lever produces an increase of from 10 to 20 per cent. Another advantage of speed control is the chance it gives for making a practical system for setting cutting speeds. For example, by adopting a uniform roughing feed, and two uniform feeds, one for heavy and one for light work, the most important variable in the case is eliminated, and the speed problem becomes comparatively easy. The report says: "In general it may be stated that while close electrical speed regulation may not be theoretically necessary, it presents a practical method of increasing the output from shop machinery that can not be approached by the old belt and cone pulley, and that this increase in output should largely outweigh the slight additional cost, and in any shop where this small increase in outlay can be made in order to effect a substantial economy in operation, in other words in any shop that is laid out on reasonable business principles, some form of speed control should be applied."

The report also discusses the various systems of wiring and of speed control.

Increased Speed with a Traction Reducer.

When the traction increasers were applied to the large 4-4-2 engines on the New York Central, the non-technical press of the country were deeply interested and regarded a traction increaser as a mysterious agency which resided somewhere in the boiler and which gave the engineer an opportunity to suddenly develop any amount of power when nobody was looking. Such an ordinary matter as the transfer of weight was entirely too simple to waste space on, so that columns of "mystery" was the order of the day.

The non-technical press are now busy with a new idea which has been worked out by Prof. A. C. Albertson, an electrical engineer, late of Copenhagen University in Denmark. His idea, according to the descriptions which have appeared in the public prints, includes a train of cars, electrically driven, which shall run on an elevated structure, at the modest rate of 300 miles an hour. That is, a speed of 440 feet per second will be attained. How far Prof. Albertson's scheme is correctly reported we cannot just now tell, but it is said that a one horse-power engine, operating at one-sixth the cost of an ordinary railway, will pull wheelless cars at the speed quoted above.

The way all this is done is simple enough on paper. The cars are mounted on two trucks having very small wheels, but these trucks and wheels are not used in running, but are for the cars to sit down on after a stop has been made. From the body of the car at each end, attached to the car sides supports pass down each side of the girder of the elevated way and on the ends of these supports are powerful electro-magnets so placed as to slide along the bottom face of the girder. When current is turned on, magnetic attraction carries the electro-magnets close up to or nearly touching the bottom face of the girder, this lifts the car up, small trucks and all, and severs all connection between the underside of the car and the top of the girder.

The weight of the car, acting downward, and the upward effort of the magnets are said to so nearly balance each other that the car becomes as light as a feather, so to speak, and therefore can be moved along with the expenditure of very little power. If, for example, a car weighs 20 tons, magnetic force capable of producing an upward effort of 21 tons could be turned into the coils, and the car would "weigh" one ton as far as the engine was concerned, and the friction would then be equal to a weight of one ton being drawn along the track. Just how far this is true, and if true how the application of the principle will be worked out for a train of full sized cars, we will not attempt to say. A working model is said to be on exhibition, which demonstrates the truth of the theory.

We are further told that current necessary to supply 1,000 electric lights of ordinary power would suspend a weight of 120 tons or six cars each weighing 20 tons. The locomotive to be used would, of course, be electrical, with large drivers and supplied with the "weight reducing" apparatus as is used on the cars and apparently as tractive effort will be a matter of no importance to this engine, it becomes easily master of the situation.

One of the objections which may be urged against the whole scheme, is that if the magnets actually touched the underside of the girder, they would develop considerable friction even at moderate speeds, and the parts would certainly require lubrication, and constant adjustment for wear. If the magnets were not allowed to touch the girder, their lifting power would be lessened, and wheels would have to be introduced, and when that is done we are at once face to face with the old hot box problem, which it is so joyfully stated will disappear from the wheelless car on the 5-mile-a-minute train. When it comes to the very high speeds talked about in connection with this railway, we may say that at the present time, mankind does not know anything about wind resistance to cars, or the effects of weather conditions or storms at these velocities for the simple reason that so far nobody has traveled continuously 300 miles an hour. The railway requires to be built and the whole thing done exactly as theoretically outlined, before it is worth anything to the public, and the building and the doing are the two things we are not likely to see much of.

The Traveling Engineers on Locomotive Front Ends.

The committee's report on Locomotive Front Ends with the very long discussion which took place at the Traveling Engineers' Convention last month, to which we devote liberal space in this issue, are well worthy of careful study. An attempt was made to find a front end or design one that the Traveling Engineers' Association could recommend to railroad companies as a standard; but instead of advancing those interested towards uniformity, the report and the discussion revealed an amazing diversity of practice and great conflict of opinion about the utility of the appliances most commonly used. We had supposed that the dimensions and appliances which produced the most satisfactory results, in the investigations and tests made by the committee of the Master Mechanics' Association in 1896, of which Mr. Robert Quayle was chairman, would have been used as a basis for designing front ends and their attachments, but the remarks of the various speakers indicated that very little attention has been given to conclusions reached by the Master Mechanics' Committee. That may have been due in some measure to the fact that the Master Mechanics' Association made no specific recommendations of particular forms or dimensions, merely stating what produced the best results in creating draft. But the discussion revealed the tendency of different railroad companies and individuals to go on experimenting for themselves regardless of what had been found out by others better equipped to make accurate experiments.

Great allowances must be made for individual tastes and prejudices, full attention must be given to varied conditions of fuel and service; but when one man throws away and utterly rejects as worthless things which the majority of motive power people have found to be so valuable that they are indispensable in making an engine steam freely, there is something wrong, something demanding further investigation. Jumping at conclusions on insufficient information is a very dangerous practice when it leads to a radical change on such important devices as draft appliances, yet one listening to the discussion at the Traveling Engineers' Convention could not help feeling that very little judgment was displayed in the actions described by some of the speakers or in the conclusions

they arrived at. To do things differently from others may be impressive, but it is dangerous.

The most hopeful thing connected with the discussion happened at the conclusion, when Mr. W. G. Wallace got the following resolution carried:

Resolved, That we, the Traveling Engineers' Association, recommend no special or definite front end arrangement at this time, but do recommend that the facts developed by the Master Mechanics' Association and by Professor Goss, of Purdue University, be made our basis for future work and research; and, further, we believe the greater part of the difficulties experienced in service are due, more to lack of system in keeping the appliances adjusted, so as to give the best results, than to the mechanism itself.

The Unresilient Driving Wheel.

The surprisingly high speed attained by automobiles using pneumatic tires has moved inventors to scheme on the production of some elastic medium intended to soften the blow of tires on the track and incidentally to reduce the noise. There is certainly urgent need for an invention of this character, but it is very doubtful if anything practicable can be produced. Springs were first applied to railway vehicles because the engineers of permanent way discovered that the unresilient weight inflicted severe injury on the rails, and it was found that the intervention of springs between the load and the rails materially lessened the damage of the rolling blows.

The early locomotive builders were quite alert to the necessity for making the wheels of their engines as easy as possible on the track, and it was a common practice to insert a lining of wood between the wheel center and the tire. Mr. M. W. Baldwin obtained a patent on a wheel of this kind which was illustrated on page 352 of our August number. George S. Griggs, master mechanic of the Boston & Providence Railroad, patented a resilient wheel and had great success in using it. On an inferior track his wheels fitted with Lowmoor tires made as much as 140,000 miles to the inch of wear. Some difficulty was experienced keeping the tires tight on the soft lining, but the invention was not abandoned on that account. The practice originated and progressed of shrinking iron or steel tires upon cast iron centers. It was an easy way of securing the tire, and the ordinary railroad mechanic never paid so much attention to a little expense as he did to convenience, so the resilient tire gradually went out of fashion. It never was conclusively demonstrated that elastic wheels were less destructive on the track than wheels with solid centers, and nobody displayed much anxiety to find out. The use of wooden lining between wheel centers and tires was sufficiently prolonged to prove its efficiency, for in a report on tires submitted to the American Railway Master Mechanics' Association in 1869, five railroad companies were reported as using wooden blocks between wheel center and tire. That practice would not have been adhered to so long, if it had not possessed merit which appealed to the master mechanic keenly interested in securing all the wear possible out of tires. With the light engines going out of use thirty years ago and the introduction of steel rails, there was probably little difference what kind of wheel center was used, but we think that modern conditions demand that something be done if possible to soften the blows of the heavy driving wheels, now pounding over the rails at double the velocity common when engineers first demanded the general introduction of springs.

The whole weight of the pioneer locomotives built in the days when the necessity for the use of resilient driving wheels was first acknowledged, was frequently little more than the driving wheels of a modern locomotive with their attachments. Baldwin's second engine weighed about seven tons and the driving wheels of a modern passenger engine weigh nearly as much. The following may be accepted as an approximate weight of one pair of driving wheels 72 inches diameter with their uncushioned attachments:

Weight of wheel centers........	6 300 lbs
Weight two tires 3 x 5½ inches.	2,600 lbs
Weight one [illegible] x 12 ins. driv. axle	700 lbs.
Weight four eccentrics..........	600 lbs.
Weight four eccentric straps...	500 lbs
Weight two crank pins.	250 lbs.
Weight two steel driving boxes.	800 lbs.
Weight main and side rods......	500 lbs.
	12 250 lbs.

We have heard a great deal about the destructive effects of the "hammer blow" imparted by the unbalanced forces in a revolving driving wheel, but we think that the impact of the great unresilient weight is sufficient to commit serious damage to rail joints and frogs, without the addition of other disturbing forces being taken into account.

We recently heard objections made by a number of railroad officials to the use of brick arches in locomotive fire boxes on the ground that a boiler could not be washed out immediately on arrival off a trip, because the brick arch held the heat so long that the fire box sheets were liable to receive damage from overheating. That confesses a reckless want of care of the boiler which ought to have time to cool before washing out is commenced. But it represents the prevailing tendency to rush the engine back into work regardless of fair usage. It has no doubt been the same spirit of rushing the motive power which led the practice of putting a [illegible] between the wheel center and the tire to be abandoned. Applying that lining was a tedious operation which required careful work that could not be rushed. It would probably hold an engine in the shop a few hours more than would be necessary [illegible], and so the practice was discontinued in [illegible] of locomotive operating that have developed of late years.

In the early days of railroad operating the chief engineer exercised much greater power than he does to-day; and he always opposed practices calculated to injure the track. We believe that had the chief engineer of to-day been as influential as he was forty years ago, a vigorous fight would have been waged against the solid driving wheels and all their uncushioned attachments.

Mr. George Richards, the veteran retired master mechanic who was associated with Mr. George S. Griggs, writes to us:

Mr. Griggs took out a patent on the wood block wheel and used it with good results on the B. & P. R. It was also used on several other roads. After his death his heirs sold the patent to parties who did not push it. There is need of some one with a push with moot inventions. It was used most with iron tyres and increased their life very much, and I never heard of a broken tyre which was set on the wood blocks.

The edition of Blackall's Air Brake Catechism, which we have been selling at $1.50 per copy, has been exhausted, and we are therefore not in a position to fill the many orders which have come in for it. A new, revised and enlarged edition of this valuable book will be out toward the end of September. It will contain 310 pages, 100 illustrations and 11 folding plates, including three printed in colors. This is the eighteenth edition, and the price will be $2.00 per copy.

A curious feature of the discussion on Locomotive Front Ends at the Traveling Engineers' Convention was the play on the expression, "a delusion and a snare." Mr. Roesch applied it to the double lift pipe in the smoke box, then during the protracted discussion that ensued nearly every speaker used the expression.

Some of the magazines have been publishing notices of rich men and calling them captains of industry. In several cases sharks of industry would have been a very appropriate title, for the "captains" never did an honest day's work in their lives.

QUESTIONS ANSWERED.

(62) Apprentice asks:

What is the difference between stress and strain, when used in a mechanical sense?—A. Stress is distributed force and tends to change the shape of a body; strain is the amount of change of the shape of the body caused by the application of stress.

(63) A correspondent or subscriber in Australia writes:

"Why is the throttle valve on our very big engines (10 wheelers) so very difficult to open in full gear, and by winding up the gear near center the throttle is quite easy to open? This question particularly applies to the engine from a locomotive firm in Manchester." If our correspondent had given some more particulars about the kind of throttle used and where it is located, we might be able to answer the question. (We, however, refer the matter to our readers; perhaps some of them can suggest what it is.)

(64) L. A. M. writes:

I am one of the men who listened to the discussions at the Traveling Engineers' Convention last week, and I am convinced that little progress has been made by railroad companies to abate the joint nuisance of locomotives throwing sparks, dirt and smoke. When the nuisance cannot be stopped it ought to be shorn of its annoyance to passengers, and I am working on a scheme to lead the fire gases back to the end of the train. Could you help me to induce some railroad company to give the invention a fair trial? If you will pay the expenses of the patent I am willing to give you a quarter interest. A.—At the convention referred to the editor of RAILWAY AND LOCOMOTIVE ENGINEERING said that people investigating the efficiency of railway appliances ought to read up on what had previously been done in the line under investigation. If our correspondent had done this he would have found an arrangement for carrying the gas and cinders of the locomotive to the back end of the train had been patented as long ago as 1840. Practically the same thing has been invented periodically ever since.

(65) W. B. says:

We have two water tanks and a dispute has arisen about the pressure to be obtained from them. They are about twelve feet high, but one of them is about 20 feet diameter and the other is about 10 feet diameter. I say that a greater pressure of water can be got from the big tank than from the small one, but I do not know how to figure it and some of the men say I am wrong. We decided to refer the question to you. A.—The pressure depends upon the height of the water, and the diameter of the tank has nothing to do with it. The pressure per foot of height is about .433 pound, or nearly half a pound. Thus the pressure at 10 feet head is 4.33 pounds, at 20 feet, 8.66 pounds, and so on.

(66) T. C. S., Durand, Mich., asks:

1. In making report of defective packing in a cylinder which would be proper to say, examine cylinder packing or examine piston packing? Should you desire to report metallic packing for piston rod would you make this report: "Examine piston rod packing?" A.—"Cylinder packing" is all right, but there seems to us to be no ambiguity in saying piston packing when you mean the packing rings of the piston, or in saying piston-rod packing when you mean the metallic packing rings which surround the rod. The blow of steam which the rings are intended to prevent is past the piston in one case, and past the rod in the other, and it is logical to use words indicating those parts. 2. You are disconnecting an American type standard engine; you disconnect valve rod and cover the ports, disconnect back end of main rod, shove crosshead ahead in the guides, block it there and let main rod hang in the guide yoke; would this be considered better practice than to take down both ends of this light main rod, putting it away, blocking crosshead back in the guides, no haste being required in the case? A.—The better practice is to take down the main rod and get it out of the way. One can never be quite certain of the behavior of a disabled engine on the road, and strange things sometimes happen. If the crosshead was badly blocked you might have serious trouble. In any case it is advisable to block the valve on the center whenever you can. 3. You have an engine with front cylinder head gone; no damage to cylinder, piston, packing or follower head; you have a passenger train and are within five or ten miles of a terminal, favorable piece of road part down hill, engine being a free steamer, would you think it advisable and possible to start this train and maintain steam pressure enough to handle the train this distance, avoiding delay disconnecting; also in this connection in starting the train would the jar be greater or less with the engine in this connection or working only one side? A.—We have known it to be successfully done where conditions are favorable as you describe, but it is not good practice. It requires the taking of chances of running out of steam at a critical point, in any case it wastes steam profusely, and would, especially on the right side, tend to dangerously obscure the engineer's view of track and signals. If the engine be carefully handled the jar would not be so very heavy, because high speed could not be made under steam.

Your other questions will be answered next month.

(67) J. W., Toccoa, Ga., writes:

In running an eight-wheel passenger engine, weight about 72,000 lbs., rear axle on front truck broke in center of journal. Everything was running perfectly cool and in good shape. Can you give any reason for this breakage? A.—There are several possible causes for this. The axle may have been defective from the beginning, service simply developing an inherent flaw or defect. The journal may have been very hot at some previous time and have been improperly treated. The material may not have been thoroughly fibrous in structure and may have crystalized in service and so become brittle, or for some reason the journal may have been worn or have been carrying an excessive load.

How Expense of Front-End Tests May Be Met.

The chairman of the committee of the American Railway Master Mechanics' Association appointed to help in the investigation of locomotive front ends undertaken by the *American Engineer and Railroad Journal* has made application to the executive committee to provide money to defray the expenses of the tests. As the association does not have any money available for such an expenditure, there is danger that the tests may not be carried out. As the work was originated by the *American Engineer and Railroad Journal* an impression is abroad that the enterprising proprietor of that publication will say to the committee, "Proceed with the work, gentlemen, I have got valuable advertising from the work of this committee, and I am ready to pay all the expenses necessary for finishing the tests."

The thirty-fourth annual convention of the Master Car and Locomotive Painters' Association was held in Chicago in the second week in September. Among the reports of committees may be mentioned the paper on the Proper Method of Painting and Maintaining a Locomotive Engine, and the paper on Best Method and Material for Painting and Maintaining Steel Cars. There were several essays read at the meeting, one by Mr. J. A. Cohen, of the Big Four, was on the copper-sheathed cars; Mr. J. H. Pitard, of the Mobile & Ohio, discussed the question. Is the authority and responsibility of the Master Painter coequal? And Mr. C. Clark, of the Nickel Plate, took up the matter of Harmony in Color in finishing and furnishing the modern railway passenger car.

The New York sales offices of the Nernst Lamp Company have recently been removed from the Equitable Building and transferred to the new Hanover Bank Building, No. 11 Pine street, New York.

Baldwin Engines for the Wabash.

The Wabash Railroad have recently ordered 32 fast freight moguls of the two-cylinder or cross compound type from the Baldwin Locomotive Works of Philadelphia. The cylinders are 20½ in. and 32½x28 ins. and the driving wheels are 63 ins. in diameter. The pressure carried is 200 pounds, and the calculated tractive effort is about 24,900 pounds. The main driving wheels are the only ones not flanged.

The weight of the engine in working order is 148,880 pounds, of which 139,660 pounds rest on the drivers, while the total weight of engine and tender are about 269,000 pounds. The crosshead is of the two guide bar type, and the piston rod is secured to it by nut and shoulder.

The motion is of the usual indirect kind, and the valves are balanced slide valves. The yoke or what may be called the spectacle plate is secured across the frames in the usual way, but as it does not entirely surround the guide bar blocks, it is supported from a bracket on the boiler by means of a bar with pin connections top and bottom. The leading drivers and the pony truck wheels are equalized together and the main and rear drivers are also equalized together.

The boiler is an extension wagon top, the gussett sheet sloping to the smokebox. The smallest diameter of the boiler is 63¼ ins. and the largest diameter is 71¼ ins. The roof sheet slopes 3⅞ ins. toward the back sheet and the crown sheet has also the same slope toward the back.

The tender has arched bar trucks and the tank, which holds 6,000 gallons, is supported on a steel channel frame. The tender axle boxes are provided with rubber hose tubes so that cold water may be used in the event of a hot box showing itself.

The whole machine presents a neat appearance and reflects credit upon designer and builder alike. The engineer has been provided with a very ample window and has all the light which can be obtained in that way. A few of the leading dimensions of these engines are as follows:

Cylinder—20½ ins. and 32½ x 28 ins.
Boiler—thickness of sheets, [illegible] x $\frac{11}{16}$ in.; working pressure, 200 lbs.; fuel, soft coal; staying, radial.
Fire box—length, 114 ins.; width, 42 ins.; depth, front, 77$\frac{13}{16}$ ins., back, 63$\frac{1}{16}$ ins.; thickness of sheets, sides, $\frac{5}{16}$ in.; back, $\frac{5}{16}$ in.; crown, ⅜ in.; tube, [illegible] in.; wat. space, front, 4 ins.; sides, 3½ ins.; back, 4 ins.
Tubes—material, iron; wire, gauge 12; number, 290, dia., 2 ins.; length, 11 ft. 4⅝ ins.
Heating surface—fire box, 169 sq. ft.; tubes, 1,712.7 sq. ft.; tot., 1,881.7 sq. ft.; grate area, 33.25 sq. ft.
Driv. wheels—dia., outside, 63 in.; jour., 9 x 11 ins.
Engine truck wheels—dia., 30 ins.; jour., 6 x 10 ins.
Wheel base—driving, 14 ft. 0 ins.; total engine, 22 ft. 7 ins.; total engine and tender, 51 ft. 2½ ins.
Weight—on driving wheels, 129,600 lbs.; on truck, front, 19,220 lbs.; total engine, 148 880 lbs.; total engine and tender, about 269,000 lbs.
Tank—capacity, 6,000 gals.

The Missouri Pacific people at the St. Louis shops often have occasion to finish their piston packing rings on a boring mill in order to save the use of some of their busy lathes. When the outside of the drum has been faced off and the inside bored out to the required size, a gang tool, specially made for the purpose, is put in, and four rings are cut off at each operation. This saves a great deal of time, as the adjustment for the top ring is made with a spacer and all the others are evenly divided by the gang tool. This operation is somewhat more than four times as fast as if each ring were cut off by itself by reason of the facility of adjustment, and at the same time it is a guarantee of absolute uniformity.

Railroads to Build Their Own Motive Power.

Before many years, say a series of press dispatches, most of the western roads will be in a position to build their own locomotives. Until recently few locomotives were built in the West, and the railroads had to depend entirely upon the big eastern locomotive works for all of their motive power. Owing to the great demand for locomotives during the last few years, the eastern locomotive concerns have not been able to turn out without much delay all the locomotives needed by the western roads, and now these roads have taken steps to make themselves independent of the eastern builders. The practical result of this fine scheme will be that Wall street influences will order all the locomotive building shops closed, as soon as trade depression arrives. Then skilled labor will be scattered to all parts of the country where employment can be obtained and the railroads will have to order their power from eastern shops as soon as prosperity returns. That is the way history repeats itself.

Spoiled the Banquet.

Some years ago the Lodge of Locomotive Firemen bought a valve model for educational purposes and they had a little difficulty with it. They met in the lodge of the Order of Elks and the Master of the Firemen's Lodge asked the old he-Elk where they could put it. He told them to put it into the banquet-room, but to get a case made for it so that it would not be injured. The carpenter employed made a box to go over it that would take up the least room, and when it was done and stained it looked just like a coffin set up on legs. A few days after it was in place, the old he-Elk sent for the secretary of the lodge and asked him what in the name of the everlasting gee-whiz they had in that casket. Said he: "We tried to have a little banquet after initiation last night, but the boys couldn't enthuse with that thing there, and the whole thing was solemn as a church, so the lodge voted that I tell you to please remove the remains or get a new hall—we don't keep a vault."

The Chicago & Eastern Illinois have been using the Brewer fire door, which was illustrated in our July number, and are highly satisfied with it. They have recently given an order for the door to be applied to ten more engines.

BALDWIN ENGINE FOR THE WABASH RAILROAD.

Air-Brake Department.

CONDUCTED BY F. M. NELLIS.

Air Signal on Air-Brake Train Pipe.

A correspondent asks if any one has ever devised a scheme to operate the air signal on the train pipe of the air-brake. For his information and that of others we would say that as far back as 1876 Mr. Westinghouse patented an air signal to operate on the train line of the brake system. This scheme is illustrated in accompanying cuts in this department.

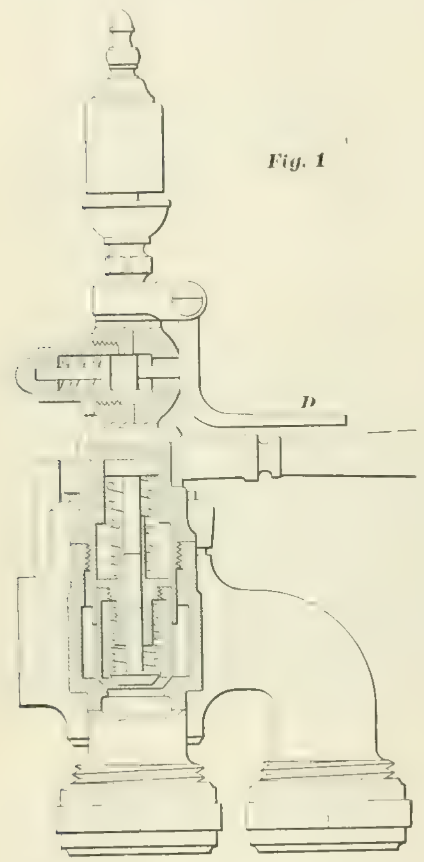


Fig. 1

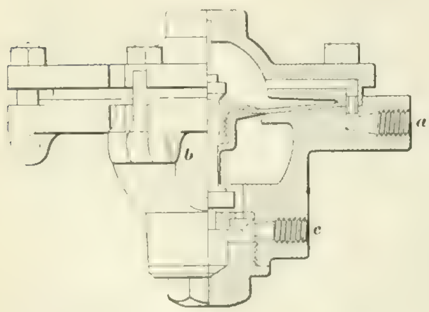


Fig. 3

To give the signals with this arrangement, a modification of the three-way cock, the brake valve then in use, was necessary. The construction of this valve is shown in Figs. 1 and 2. The connection from the main reservoir is made to the union *A*, the brake pipe is connected to the union *B*, and the branch *C* forms a discharge port. The modification consists of the introduction, in the reservoir connection, of a piston valve for limiting the diameter of the opening to the brake pipe to one-eighth of an inch at all times, except when the brakes are to be released, when this valve, by moving the handle of the three-way cock to the position shown in Fig. 2, is raised from its seat, leaving the passage unobstructed. The slightest return of the handle toward its central position reseats this valve, leaving the opening one-eighth inch as before.

A further modification is the small whistle and valve screwed into the top of the plug and connected by the union *d*' with the port *c*, of the diaphragm valve. The piece *D*, by opening a side port, enables the engineer to prevent the blowing of the whistle while operating the brakes. This, of course, throws the signaling device out of commission, meanwhile.

The diaphragm valve, Fig. 3, has a port, *a*, connected to the brake pipe, through which air passes to the signal reservoir, located at some convenient point under the cab or running board, which latter is connected to the port *b*, charging it with the same pressure. A slight reduction of pressure in the train pipe causes the excess of pressure in the reservoir, acting upon the diaphragm interposed between the ports *a* and *b*, to open a valve which permits the air to pass from the reservoir to the port *c*, to the pipe connection *d*, on the three-way cock and valves to the whistle, sounding it until the equilibrium is restored on the two sides of the diaphragm.

Fig. 4 shows the car-brake valve for application of the brakes and the giving of signals. The connection from the main brake pipe is made to the port *f*, leading into the chamber *F*. A second chamber, *G*, has a connection, *g*, leading to the atmosphere. The chambers *F* and *G* communicate through a port closed by a valve having a rubber face, which is held in its seat by a small spiral spring assisted by the air pressure. The cord extending through the car is attached to the lever *H*, and, when pulled, opens the port between the chambers *F* and *G*, discharging the air through the port *G* and into a small pipe leading through the bottom of the car. As will be seen, the signal valve is really the beginning of the present conductors' valve which is now used to apply brakes only.

In addition to this patent held by the Westinghouse Co., a number of similar patents have been gotten out by railroad and air-brake men from time to time. Our readers will recognize the weakness of the scheme in the fact that signals cannot be given at the moment that brakes are either being applied or released, and can only be made effective at such times as the pressure in the train pipe is in equilibrium and is not flowing in or out.

Fig. 2

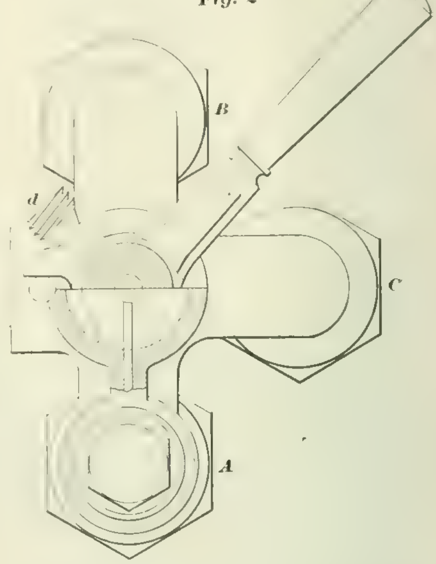
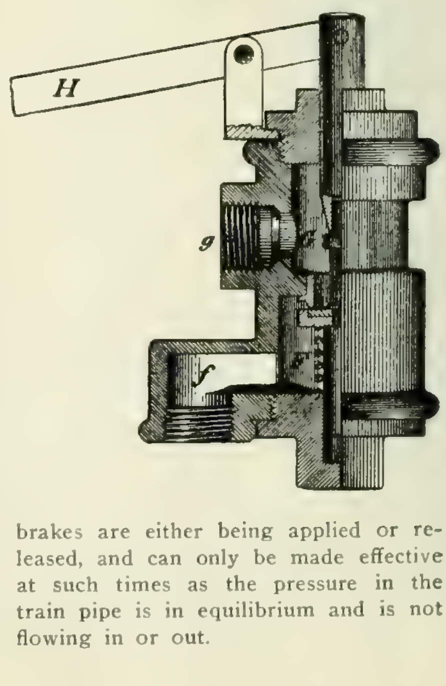


Fig. 4.



Oil Cup for the Air Cylinder.

The accompanying cuts of an oil cup for the air cylinder of the pump has been invented by Mr. Frank Bickel, of the New York Air Brake Co., and is in quite successful and extensive use on the Central Railroad of New Jersey.

Fig. 1 is a sectional view of the cup

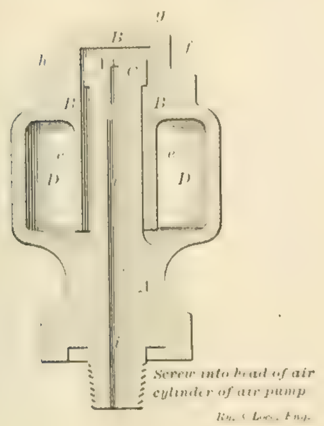


FIG. 1.

body. Figs. 2 and 3 are dimension cuts of the cup body and cap nut respectively. Fig. 4 in a dimension and illustrative cut of the "choke" or piece containing the restricted feed port. The operation of the cup is as follows:

The air pressure comes up from the air cylinder through the passage i, port g, chamber f, and down through port e into chamber D. As the pump runs, the oil in chamber D is supposed to vaporize and pass from chamber D up through passage e, and down through restricted port g and passageway i into the air

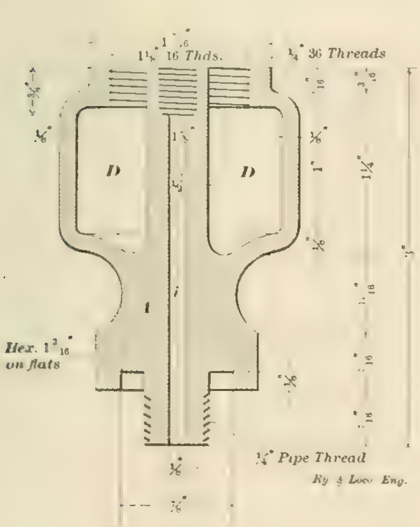


FIG. 2.

cylinder. Drops of oil do not rise from the quantity in chamber D and pass to the air cylinder as might be supposed, but is carried along with the air in a vaporized form. In other words, the air going to chamber D in the oil cup, becomes lubricated from contact with the oil, and carries a certain amount of oil in vaporized form with it back into the air cylinder.

Air Pump Tests.

A correspondent writes interestingly in this department of the air pump tests discussed at the last Air Brake Convention. These tests were four in number, and were briefly and substantially as follows:

The first test consisted of a drilled diaphragm placed either in some convenient point near the brake valve or at the rear of the tender, and the pump run at about 100 or 140 strokes per minute, being required to keep up a pressure against a 3-16 in. opening in the diaphragm.

Test No. 2 consisted of a similar arrangement described in No. 1, except that the speed of the pump was about 60 or 70 strokes per minute, and was required to keep up a pressure against an escape port 3-32 in. in diameter.

Test No. 3 consisted of a gauge screwed into the bottom head of the air cylder of the pump, and at a slow speed, pressure passing by the packing rings would pile up in pounds in the suction end of the cylinder and show on the gauge.

Test No. 4 was called the "oil cup test" and was made by opening the oil cup on the top end of the air cylinder, and running the pump at a slow speed. If air blew out of the oil cup on the down stroke, it meant a leakage of pressure past the packing rings. This degree of leakage either passed or condemned the pump.

Hot Boxes.

A correspondent asks if a hot journal or "hot box" will have any tendency toward wheel sliding. As our engineer and firemen readers have observed on trains, a "hot box" will cause a train to pull much harder. In fact, when an engineer discovers his train to be pulling hard he invariably looks about to find whether there is not a "hot box" or two on the train. On the other hand the cooling of a "hot box" or replacement of the old brass with new one, has ofttimes been done and train been found to pull easier.

Some Competitive High-Speed Brake Tests.

During the months of May and June, 1903, some interesting high-speed brake tests were held by the Central Railroad of New Jersey, being placed under the direct supervision of Mr. T. L. Burton, General Air-Brake Inspector of that system. The apparatus used was that of the New York Air-Brake Co., which consisted of a pop or safety valve, and the automatic reducing valve of the Westinghouse Air-Brake Co. We append herewith [illegible] will be interesting and instructive to our readers.

It should be noted that in all New York [illegible]

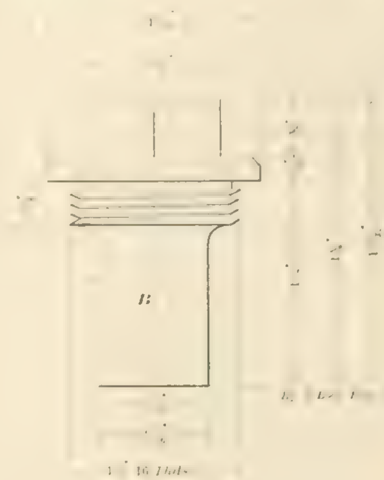


FIG. 3.

70 lbs. was retained by the use of their safety valve. This 70 lb. final brake cylinder pressure resulted in a terminal braking power of about 115 per cent. There was no wheel sliding from the use of these valves because of the favorable weather conditions that prevailed. In competition with these special safety valves and unusual conditions, the Westinghouse special high-speed reducing valves were used. These valves were set to close at 60 lbs. final brake cylinder pressure; but they were so adjusted that the blow down of pressure from the highest to the final 60 lbs. required a longer time than does the standard type of reducing valve, thus putting the apparatus of both companies on substantially the same basis. The results of these tests are shown in Table No. 1.

Upon the completion of the tests with

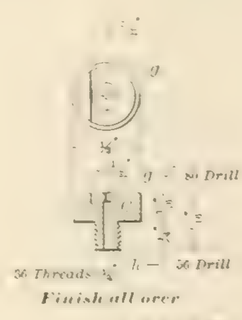


FIG. 4

this special apparatus, it was decided by the railroad representatives that the use of so high a final brake cylinder pressure as 70 lbs. was not adapted to general service, and especially to poor rail conditions. Therefore, a second series of tests

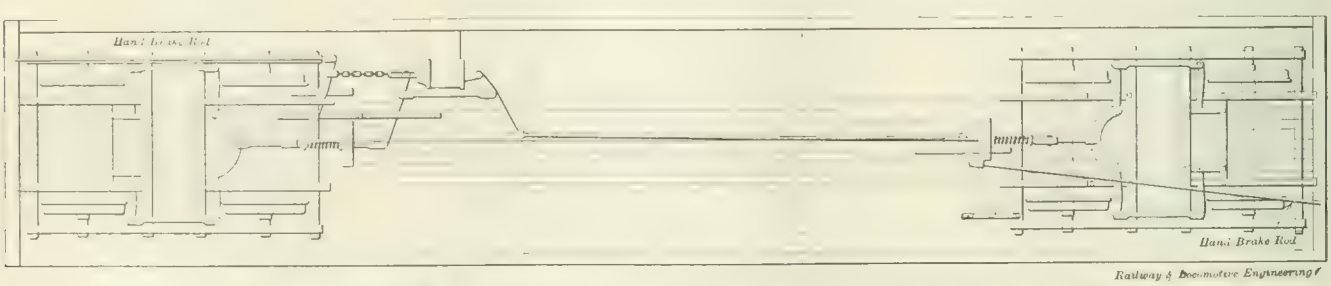
TABLE No. 1. COMPARATIVE TESTS OF HIGH-SPEED BRAKE

On the Central Railroad of New Jersey, Near Atsion, New Jersey, May and June, 1903, Between the Westinghouse Air Brake Company and the New York Air Brake Company.

No. of Test.	Kind of Brake	No. of Cars.	Actual Speed, M. P. H.	Actual Brake-Pipe Pressure, Pounds.	Actual Length of Stop, Feet.	Speed for Calculated Stop, M. P. H.	Brake-Pipe Pressure for Calculated Stop, Pounds.	Length of Calculated Stop, Feet.	Average Length of Calculated Stop, Feet.	Amount Shorter Stop by Westinghouse Brake, Feet.
9	Westinghouse,	3	78.60	110.3	2053.00	80	110	2133.44		
10	Westinghouse,	3	79.64	110.5	2108.00	80	110	2137.09	2099.96	
11	Westinghouse,	3	77.92	109.7	1929.75	80	110	2029.37		
17	New York,	3	77.58	109.5	2152 25	80	110	2270 96		208.23
18	New York,	3	78.60	109.6	2255 16	80	110	2334.92	2308.19	
19	New York,	3	80.35	109.5	2340.75	80	110	2318.71		
22	Westinghouse,	3	70.03	109.2	1595.58	70	110	1579.23		
23	Westinghouse,	3	70.86	109.6	1572.75	70	110	1529 99	1554.61	
29	New York,	3	69.23	109 3	1540 58	70	110	1573.19		29.07
32	New York,	3	68.70	109 5	1537.08	70	110	1594.23	1582 68	
33	New York,	3	69.23	109.3	1548.00	70	110	1580.63		
63	Westinghouse,	6	69.23	109.6	1262.91	70	110	1286 31		
64	Westinghouse,	6	70.86	109.3	1424.58	70	110	1381 06	1333.68	
43	New York,	6	70.31	110.0	1566.16	70	110	1552 38		237.66
44	New York,	6	70.03	109.5	1600.33	70	110	1597 60	1571.34	
45	New York,	6	70.03	109.6	1566 50	70	110	1564.06		
27	Westinghouse,	6	59 80	109.4	974.75	60	110	976.16		
38	Westinghouse,	6	60.20	109.4	995.00	60	110	982.82	982 30	
39	Westinghouse,	6	58.82	109 4	954 83	60	110	987 92		
34	New York,	6	59.60	109.1	1014.66	60	110	1026 19		32.77
35	New York,	6	59.21	109.3	968 41	60	110	992.57	1015 07	
36	New York,	6	58.82	109.0	989 25	60	110	1026 45		
40	Westinghouse,	6	51.28	109.0	656 75	50	110	618.50		
41	Westinghouse,	6	51.13	109.1	613.25	50	110	582.03	602 16	
42	Westinghouse,	6	50.84	109.1	631.83	50	110	605.95		
46	New York,	6	50.56	109.3	706.08	50	110	688.98		68.79
47	New York,	6	49.18	109 4	650.08	50	110	670.90	670.95	
48	New York,	6	50.42	110.0	664.00	50	110	652 98		
4	Westinghouse,	3	79.30	70.16	2804.66	80	70	2859.76		
8	Westinghouse,	3	78.26	71.16	2660.41	80	70	2817.97	2838 86	
2	Westinghouse,	3	70.87	71.10	2061.16	70	70	2036.90		
3	Westinghouse,	3	69 50	69.70	2055 00	70	70	2078.53	2057.71	

of a more service condition character was run in which were used only the standard Westinghouse high-speed reducing valves, thousands of which, similarly adjusted, are in successful use to-day throughout the valve, set at 60 lbs. pressure, over the ordinary pop or safety valve, set to hold a final brake cylinder pressure of 70 lbs.

Perhaps one of the most valuable bits of information derived from these tests was the greatly improved showing of the bly appreciated by reference to Table No. 2. It will be observed that the length of stop made by the use of the high-speed brake is about 30 per cent. shorter than that made with the ordinary 70 lbs. train line brake.



SHELTON BEAMLESS BRAKE AS APPLIED TO DENVER & RIO GRANDE COACH No 303.

country under the many and varied conditions of general air-brake service. The tests demonstrated forcibly the superiority of the high-speed automatic reducing high-speed brake stops, with 110 lbs. train line pressure over the stops made with the ordinary brake operated by 70 lbs. train line pressure, as will be more forci-

The proceedings of the Colorado Springs convention of the Air Brake Association is just from the press and contains much valuable information.

TABLE No. 2. TESTS OF HIGH-SPEED BRAKE

On the Central Railroad of New Jersey, Near Atsion, New Jersey, May and June, 1903; Train being Equipped with the Westinghouse Air Brake Company's Standard Valves.

No. of Test	No. of Cars.	Actual Speed, M. P. H.	Actual Brake-Pipe Pressure, Pounds.	Actual Length of Stop, Feet.	Speed for Calculated Stop, M. P. H.	Brake-Pipe Pressure for Calculated Stop, Pounds.	Length of Calculated Stop, Feet	Average Length of Calculated Stop, Feet
101	6	70.03	109.75	1527.25	70	110	1522.88	
102	6	69.56	109.80	1533.66	70	110	1541.75	1509.55
117	6	70.31	111.80	1456.08	70	110	1461.04	
104	6	61.43	109.66	1029.50	60	110	979.44	
109	6	58.41	110.25	935.75	60	110	988.34	986.24
110	6	59.60	110.50	973.92	60	110	990.95	
111	6	51.42	110.25	670.41	50	110	635.15	
112	6	49.58	110.30	622.00	50	110	634.08	634.61
120	3	76.27	100.3	1945.50	80	110	1974.37	
103	6	70.03	70.08	1972.58	70	70	1972.73	
105	6	70.58	70.00	1893.50	70	70	1862.50	1899.42
106	6	70.31	70.00	1879.58	70	70	1863.04	

CORRESPONDENCE.

Pump Repairs and Tests.

Regarding the proper test of air pumps for shop repair rooms, I would say that at the Colorado Springs Convention of the Air Brake Association last April the subject of test for air pumps was pretty thoroughly discussed, and resolved itself into four principal tests, which I will describe as follows:

Test No. 1. This test was with a diaphragm connection placed at the engineer's brake valve, or in the hose coupling at the rear of the tender. The test of the diaphragm at the brake valve was a comparatively reliable test, inasmuch that it showed the capacity of the pump, pumping against the leak in the diaphragm. The diaphragm placed in the hose at the rear of the tender, showed leaks in the main reservoir connections, the train pipe and the auxiliary reservoir, and did not show reliably the condition of the air cylinder of the pump.

Test No. 2. was a similar test to No. 1, except that the speed of the pump was much slower. In the first test the pump was run at a speed of about 130 strokes per minute against a 3-16 in. opening in the diaphragm. In test No. 2 the pump was run at about 60 to 70 strokes per minute against an opening of 3-32 in. It would appear to many that this was the better test of the two.

Test No. 3 consisted of a gauge screwed into the bottom head of the air cylinder of the pump, and a speed of about 40 strokes per minute obtained. In this test the gauge would show the pressure leakage past the packing rings into the suction end of the cylinder, showing up in pounds on the gauge. In this test the gauge would show also the leakage past the discharge valve in the main reservoir, allowing the pressure to come back into the cylinder, thereby confusing the test, unless the discharge valves had been previously tested.

Test No. 4 consisted of opening the oil cup on the top end of the air cylinder, the pump run at a slow speed, and on the down stroke, if pressure passed by the packing rings, it should blow out of the cup. This test is good and simple but does not tell the degree of leakage past the rings, except to practiced and skilled repairmen; but then, only practiced and skilled repairmen should work on air pumps.

These four tests combine some very good features, and I think all air brake men should be able to select from a combination of these a good test for themselves.

J. S. Kranbean.

Flushing, L. I., New York.

SHELTON BEAMLESS BRAKE AS APPLIED TO DENVER & RIO GRANDE R. R. COACH No. 703

QUESTIONS AND ANSWERS

ON AIR BRAKE SUBJECTS.

(72) A. L. B., Birmingham, Ala., writes:

I find a lot of trouble in trying to study the air brake from the instruction book gotten out by the air brake manufacturer. Is there any plainer book on this subject that I could get to help me study the brake and get a good understanding of it? A.—We do not know of any simpler book than the one gotten out by the manufacturer of the air brake. You can greatly reduce your difficulty if you get some one to study with you. In this way one can follow the designation figures and parts on the charts while the other reads aloud the explanations. We have known this to be tried in several cases with very good results.

(73) G. E. L., Council Bluffs, Iowa, asks:

Which is the best engineer for mountain work, the one who holds his train a long time between releases and recharges, or the one who recharges frequently? A.—Without question the man who makes moderately light applications and frequent recharges is the better man from an air brake point of view, and possibly all others. The man who recharges infrequently is obliged to draw

down his train pipe auxiliary reservoir pressures dangerously low, thereby requiring considerable time to get it up again to where it becomes efficient. In the meantime, if emergency should arise requiring the train to be stopped, sufficient braking power would not be available and could not be obtained in time to do it. On the other hand, the engineer who recharges frequently and makes short holds, always has a higher train line and auxiliary reservoir pressure, is ready for emergencies, and always has his train under control.

(74) J. M. E., Cleveland, O., asks:

What causes air whistle to sound on an engine every few minutes when engine is moved slowly, but when engine is coupled to train and running either fast or slow, the whistle never sounds except when signal valve is operated in the coach. Applying brakes or releasing them does not affect the whistle. It simply sounds of its own accord. The reducing valve, release valve and all pipes and connections are apparently in good order. A.—The stem of the signaling valve probably fits too snugly in its bushing, or is gummed with thick or burned oil. This, in connection with very small, imperceptible leaks in the signal line on the engine and tender, will cause the whistle to sound from no apparent cause. When this engine is coupled to a train the volume of signal line pressure is increased, and the small leaks thereby loose their influence over the signaling valve.

(75) E. R. L., Buffalo, N. Y., writes:

On some of the Pullman cars the triple valve will blow for a long time after the train has come to a standstill. Also on some of the coaches I have observed that the brakes release so slowly that the exhaust will blow half way to the next station. A.—This is undoubtedly due to an excessive length of piston travel, which permits the cylinder to take a large volume of air at each application; and, in releasing this large volume, the pressure must necessarily take a long time in passing out at the exhaust port of the triple valve. Generally, but not always, a long piston travel can be discovered by the length of the exhaust of the triple valve; however, this is not true in cases where the exhaust port of the triple valve has become clogged and its opening reduced by accumulation of dirt and oil.

(76) J. M. E., Cleveland, O., asks:

Can an engineer with his brake valve release 3 or 4 cars on a front end car, on the rear end, or in the middle, as he sees fit? One engineer here says he can do this on any cars in train that he likes. A.—No. It is impossible. This is an old bit of foolish bragging. However, on a train of 7 or 8 cars, or thereabouts, the piston travel may be so adjusted that a quick shot of air from the main reservoir into the train pipe with the engineer's brake valve, will cause the long travel brake to release first, whenever it may be in the train. This is especially true if the brakes are about fully applied. By manipulating the piston travel in a train of this kind, the long travel car may be placed anywhere in the train and made to go off first. As to releasing any certain brake he is called upon to do, he can't do it. The engineer who makes the claim is making a very preposterous one, and can be shown his mistake by requiring him to release a certain specified brake.

(77) M. R. H., Montreal, Canada, writes:

My brake valve on my engine acts very queerly. When I go to apply my air in service position, the black pointer hand of my air gauge will drop down very quickly, and I get an emergency application of brakes on my train. I have cleaned the valve and it has also been cleaned and inspected by the air man, but the trouble does not disappear. Please tell me where I can look for the trouble and how to remedy it. A.—The small equalizing reservoir under the footboard is probably partly filled with water, thus reducing the capacity of this reservoir and the chamber D above the equalizing piston. In this event each time the service application is made the air in chamber D and the equalizing reservoir will quickly reduce and the black pointer suddenly drop. Again, the gasket in the union which connects the reservoir pipe to the brake valve may be crushed into the opening, thus reducing the opening through the union, in some instances almost cutting the equalizing reservoir off.

(78) G. E. L., Council Bluffs, Iowa, writes:

Will a hot journal, or hot box, cause a wheel to slide under a car, or will it have any effect in the direction of causing the wheel to slide? A.—Anything which occurs to hinder or retard the rolling action of the wheel, whether it be from brake shoe friction applied to the rim of the wheel, or to friction applied to the axle, will operate against the rolling action of the wheel and tend to produce sliding. If the friction between the journal brass and the journal is excessive, as is frequently the case with a hot box, that friction will tend toward wheel-sliding to the same degree in which the friction is applied. With the brake shoe applied to the rim of the wheel with braking power adjusted so that the brake will hold all it possibly can without sliding, the wheel, if any further friction is applied on the wheel by the shoe, or on the journal by the brass, sliding will doubtless result. Hence the hot box will have a tendency toward wheel sliding.

(79) G. F. A., Wilmington, Del., writes:

I have seen the wheels under some Adams Express cars sliding on a bad rail. Would it not be best to reduce the brake power on these cars until wheel sliding will disappear, even on a bad rail? A.—If we were to so reduce the leverage to insure no sliding of wheels whatever, even on a slippery and greasy rail, we would deprive the car of sufficient breaking force to permit it to make a reasonable stop in ordinary service; that is, if the braking power was so low as to insure absolute freedom from sliding of wheels on a bad rail, the car would not hold its share in making ordinary service stops; and, with a train of such cars, not a half way respectable stop could be made. Such sliding, as on a greasy rail, does very little damage to wheels, and it may be expected on bad rails. It will be noticed on such bad rails that the driver wheels of the locomotive will generally spin freely when starting the train out of a station. On such a rail, wheel-sliding does not spot wheels but very little.

(80) G. E. L., Council Bluffs, Iowa, asks:

Why will not the water brake do as good work and answer all purposes on a mountain engine as the combined straight air and automatic brake will do? A.—The water brake, which was advocated by air brake men until recently, and which has been in quite extensive service on mountain grades in the West, performs about the same work as does the combined straight air and automatic brake on the engine when the train is running. The particular advantage of the combined straight air brake is not only that it can be used to steady the engine and tender while the train is being recharged and held in check, but that it can also be used to hold the engine and prevent it from moving after it has been brought to a standstill. Frequently at water spouts, coal pockets and such places, it is necessary to hold the engine after it has been brought to a standstill until taking water or coal has been finished. Likewise it is necessary to hold the engine while the fireman may be cleaning the ash pan or the engineer oiling around, between the spokes of the wheels, etc. The straight air brake allows pressure to be pumped directly into the driver brake cylinders, thus holding the engine and tender, even though the packing might be poor and permit the brake to leak off. Again, the water brake is objectionable inasmuch that it will hold the engine only, and not the tender, and tends to rack the machinery to a certain extent. The straight air brake brakes on wheels of the locomotive and the tender both, and permits the engine machinery to drift free in running down grades.

Proceedings of Traveling Engineers' Convention.

THE BRICK ARCH.

The committee of the Traveling Engineers' Association presented its report, through Mr. W. G. Wallace, of the Chicago & Northwestern, on the brick arch, at the meeting recently held in Chicago. The report was headed "How do you consider the use of the brick arch in engines burning bituminous coal in deep, shallow and wide fire boxes?" A series of nineteen questions were sent out by the committee.

The replies received from members on lines where bituminous coal is used indicate that they consider the use of the arch as a powerful adjunct in steam making and economy. With an engine properly drafted less coal is required by reason of the gases being retained longer in the fire box and uniting the carbon with the oxygen in better proportion at the igniting temperature, which gives more perfect combustion.

The committee, however, say that it is not claimed that an engine can be drafted to give a more economical performance without an arch than with one, and opinions differ as to whether or not the fire will burn whiter with or without the arch, but the important assertion is made that all unite in claiming that the presence of the brick arch will assist in reducing black smoke.

No data was presented in the report to show the amount of coal used per train or per ton mile, but the committee favors the use of the arch in engines where the conditions are favorable. This appears to mean that in good water localities and where sufficient time is allowed at terminals to clean off grates, bore out and caulk flues and do necessary fire box work, the arch can be used with advantage.

The disadvantages urged against the use of the arch under conditions different to those just stated are that in poor or bad water localities and where the time at terminals is limited, the flues become stopped up and the flue sheets honeycomb behind the arch. The flue and fire box cleaners cannot bore out flues or clean the sheet and grates in the time given them with a hot arch, and the work of properly caulking leaky flues under the circumstances is well nigh impossible.

In the matter of engine failures the arch is one more cause which may produce a failure either by falling down itself or by the leaking of the supporting tubes or circulation pipes upon which the arch rests. An inexperienced fireman will probably find greater difficulty in placing coal on the grates where an arch is used than where the fire box is clear, and may therefore produce what may be called a steam failure.

The committee, however, believe that taken from the standpoint of economy in dollars and cents, on shallow and wide fire box engines, the arch is not a benefit except as above stated, where work can be done properly and conditions warrant its use.

The discussion which followed showed the keen interest taken in this subject by the members of the association, and it served to emphasize the fact that to be of use the brick arch and the engine using it must receive fair play.

The first speaker, Mr. J. J. Gill, stated that upon his road, the New York Central, a test had been made with six engines, three using the arch and three without. He said: "The first two engines were very large tandem compounds, weighing 187 tons. They had a grate area of 58 sq. ft., a hauling capacity of 4,200 tons. The next two were cross compound, weighing about 150 tons, with 53 ft. 32 ins. area, hauling a tonnage of 3,333 tons, and the next two were two simple engines in fast freight service. I would like to state here that the engine in fast freight service gave a little better satisfaction with the grate, on account of being a little sharper on the fire without the brick.

"The first three engines that had no brick in them, Nos. 2421 tandem compound, 2387 cross compound and 1753 simple engine, during that test—it was from the 18th day of May until the 10th day of August, these three engines not using the brick arch, were dumped eighteen times, something like every two weeks. On the other hand, the engines with the brick arch, Nos. 2419 tandem, 2350 cross and 1779 simple, were dumped twenty-five times, seven times oftener than the engines without the arch. During that test we kept track of the engine failures of those six engines used in this test with and without arch. The engines that had not the brick in them had no failures whatever during this ninety days for steam or leaky flues. The engine with the brick arch, one of those engines, 2350 a cross compound, had two failures, one on the 1st of July, due to flues leaking, and one on the 12th, due to too low steam and flues leaking. Two failures against the arch. Engines with a brick arch would save one ton of coal per trip of 140 miles. At that rate fifty engines on the Mohawk Division, making fourteen round trips or twenty-eight singles, at two dollars a trip saving in fuel, would save about $2,800. This test was all in

BRIDGE COLLAPSED WITH ENGINE TRYING TO START TRAIN

the freight service. We use in the freight service Beech Creek brick. These brick cost about 50 cents apiece. Ten brick to a set cost $5, labor 50 cents, engine dumped twice a month would be $11. You save about four brick, $2, leaving a balance of $9 to keep up the brick arch. Average number of trips per month on engine will make fourteen runs, or about 4,000 miles. Average to set of brick about 2,000 miles. Fifty engines at $9 per month for the brick would cost $450. Four hundred and fifty dollars deducted from $2,800 leaves a balance of $2,350 saving by the brick arch in fuel.

"On the other hand, take fifty engines without brick arch. Those engines we found by actual test could be got ready anywhere from three to four hours quicker without the brick arch. Now those engines that got ready four hours quicker dumped twice a month would be about eight hours to an engine or about 400 hours. Four hundred hours divided by twelve would equal 33 1-3 trains of eighty-five cars each, or 2,805 cars moved over a division 141 miles long in thirty days. That is in favor of the engine without the brick arch. Now if any gentleman can give us the figures what the company would realize in moving a car over the division, multiplied by 2,805 we can find just what the saving will be and put that against the saving of fuel on the brick arch.

"I sent the following letter on the subject to the master mechanic. 'In regard to brick arch test on Mohawk division I watched the performance of the engines very closely and find that the engines without the brick arch steamed just as freely as engines with the brick arch in freight service. We did not have occasion to change draft of any engine after arch was removed. Engines without the arch burned a little more coal and threw more black smoke. Coal was not weighed, consequently I cannot give exact amount consumed, but would estimate it at about 8 or 10 per cent. Without the brick arch we have the advantage of keeping the flues cleaned out and when engines are dumped for repairs they can be used from three to four hours quicker than if brick had to be cooled off, taken out and replaced. Engines using brick arch when flues become stopped up cannot be cleaned with advantage and the flues behind the brick arch which are plugged commence to leak. Another feature, without the brick arch we have no detention from brick falling down and causing low steam and time lost getting brick out of fire box on road. On the G2 and G4 class of engines the brick arch is supported by the water bars and the weight of the brick and jar of engine causes them to leak, also making engine failures. Taking everything into consideration, I think in freight service if the arch was removed and the flues thoroughly cleaned at terminals the company could use their engines quicker and to greater advantage, especially in winter, when power was being turned at each end of the division."

The next speaker, Mr. Crandall, also on the New York Central, said that on the Western division they had also been making a test and had found that more flues plugged up with the arch than without it, and without the arch flues can be cleaned more easily and quickly at terminals and they can be cleaned out if necessary on the road. With the arch, when the flues begin to leak they become honeycombed, and it is a hard matter to get the honeycomb off the lower flues, and an inexperienced fireman will get along better without an arch than with one. There is much less heat in the cab without the arch than where the arch is used.

Mr. Jas. E. Donnelley, International Cor. Schools, read his answers to the questions proposed by the committee and spoke in favor of the hollow or double brick arch, a model of which was on exhibition at the meeting.

The representative of the Santa Fe, Mr. Beardsley, said: We think we save one ton of coal in seven by the use of the brick arch, and the arch costs from $5.30 to $7.50 each. The average life of the arch is from seven to ten thousand miles, or about from five to eight weeks. It is used in all engines on all divisions with which he is connected.

Mr. E. R. Webb, of the Michigan Central, said they used the arch in passenger engines with short deep fire boxes making about six or seven thousand miles a month. He had not found a boilermaker who cared for the arch. The heat in the box is more intense with the arch than without it, and combustion better, but side sheets crack more quickly with it than without, as the flame at the sides follows the line of the arch.

The discussion was closed by Mr. Gillett, of the Norfolk & Western, who reported that his company had entirely given up the use of the brick arch, and that on a test a saving of twelve pounds per mile was made by the engines without the arch.

DISCUSSION ON FRONT ENDS.

The committee of the Traveling Engineers' Association appointed to investigate the subject of Front Ends for Locomotives started out with the idea of finding a front end that they could claim originated with the association. In their search for originality of design they were no more successful than Diogenes was in finding an honest man. The nearest approach to perfection they found was a modification of the front end recommended for standard of the Master Mechanics' Association, by Mr. Robert Quayle, after the experiments he carried out with locomotive front ends in 1896. Front ends of this design were tried by the Michigan Central Railroad, but did not give such good results as a front end previously used.

The master mechanics' front end was applied to a new 4-4-2 engine built for the Michigan Central, and it did not give satisfaction. Various changes were tried, and those in charge finally settled on the arrangement shown in the annexed engraving, the results having been most gratifying.

The committee discovered that the old idea, that the steam jet from the exhaust nozzle should fill the stack is a fallacy. They expressed the belief that little improvement can be made on designs already in successful use. They urge liberality on the part of members to try without prejudice some of the things known to be good, and to quit following empty theories. The best designed front end will not prove satisfactory unless surrounded by proper conditions, such as freedom from steam leaks in front end, air leaks in smoke-box, and improper alignment of nozzle petticoat pipe and smoke stack.

After the reading of the report Mr. J. A. Taltz, D., L. & W., said they had received forty Consolidation engines equipped with the Michigan Central front end, which did fairly well, but after running fifty or sixty miles the fire box would be full of dirt and clinkers. They tried a change. Instead of bringing the plate around the nozzle stand, they ran the plate back of the nozzle stand at the same angle as the deflecting plates. In addition to this, they put in a single draft pipe and removed the double one. After that change the engines would run over the division without having their fires cleaned. They also gave less trouble from leaky tubes.

Mr. Bentley, C., R. I. & P., directed attention to the value of the petticoat pipe in regulating draft, and objected to men putting the pipe wherever they pleased. He was not satisfied that the theory of the jet shooting through the stack without touching the sides was right.

Mr. Donald R. McBain, Michigan Central, took the ground that the steam jet passes through the center of the stack and that the fuel gases pass out in the annular space surrounding the column of exhaust steam. His experience went to prove that an engine with a short stack could steam as freely as one with a long stack.

Mr. E. W. Brown, D., L. & W., believed that the jet seen passing through the stack was due to steam condensation, and that expansion would cause the steam to fill part of the stack.

Mr. Taltz mentioned that the steam jet passing through the smokestack is

(*Continued on page 475.*)

Of Personal Interest.

Mr. J. A. Lynch has been appointed traveling engineer on the Chicago, Great Western with headquarters at St. Joseph, Mo.

Mr. J. H. McGonigal has been appointed traveling engineer on the Northern Pacific Railroad, vice Mr. J. H. Sally, promoted.

Mr. J. W. Shrader has been appointed locomotive foreman at Luther, Mo., on the Wabash Railroad, vice Mr. H. L. Needham, resigned.

Mr. Joseph L. Bartlett has been appointed general foreman of the Walkerville, Ont., shops of the Lake Erie and Detroit River Railway.

Mr. John P. McSteen has been appointed traveling engineer on the Chicago, Rock Island & Pacific, with headquarters at Cedar Rapids, Ia.

Mr. A. S. Wilson has been appointed acting master mechanic at Creston, Ia., on the Chicago, Burlington & Quincy, vice Mr. F. A. Torry, promoted.

Mr. J. J. Shaw has been appointed master mechanic on the Denver, Enid & Gulf Railroad, with headquarters at Enid, Okla., vice Mr. W. H. Whitaker, resigned.

Mr. M. K. Jones, heretofore yard master on the Choctaw, Oklahoma & Gulf, has been appointed trainmaster on the same road, with headquarters at Shawnee, Okla.

Mr. Mark J. Maloney has been appointed road foreman and assistant trainmaster on the Cumberland Valley Railroad, with headquarters at Chambersburg, Pa.

Mr. Lloyd Grimes, heretofore traveling engineer, has been appointed train master on the Illinois Central in charge of the Paducah district, vice Mr. J. F. Sheridan, resigned.

Mr. John H. Dacey has been appointed master mechanic of the Kansas City, St. Joseph & Council Bluffs, with headquarters at St. Joseph, Mo., vice Mr. C. E. Lamb, resigned.

Mr. F. A. Torry, formerly master mechanic on the Chicago, Burlington & Quincy, has been transferred to Chicago as assistant superintendent of motive power on that road.

Mr. Robert H. Rogers has been appointed general foreman of the shops of the Baltimore & Ohio Railroad, which are situated at Cumberland, Md., vice W. S. Galloway, resigned.

Mr. J. H. Sally, heretofore traveling engineer on the Northern Pacific, has been appointed master mechanic, with office at Livingstone, Mont., vice Mr. W. S. Clarkson, promoted.

Mr. George H. Gilman, formerly superintendent of the Tacoma shops of the Northern Pacific, has been appointed master car builder of the same road, with headquarters at St. Paul.

Mr. J. Q. Mathews has been appointed assistant superintendent of the second district, Rio Grande Western Railway, headquarters, Grand Junction, Colo., vice Mr. George Geiger, transferred.

Mr. E. G. Potter has been appointed trainmaster on the Chicago Great Western. He will have charge of the Des Moines-Kansas City section, which was formerly in charge of Mr. W. G. Whalen.

Mr. John Vass has been promoted to the position of road foreman of engines, with jurisdiction over the twenty-sixth district on the Grand Trunk Western, with headquarters at Battle Creek, Mich.

Mr. M. D. Strout, for twelve years superintendent of the Engineering Laboratory of Purdue University, has resigned that position to enjoy in his declining years a well-merited release from routine duties.

Mr. W. S. Clarkson, heretofore master mechanic on the Northern Pacific at Livingstone, Mont., has been appointed shop superintendent and is in charge of the shops and motive power of the Montana division.

Mr. W. A. D. Short, heretofore signal engineer on the Cincinnati, New Orleans & Texas Pacific Railway, has been given the title of superintendent of signals on the same road. His headquarters are at Lexington, Ky.

Mr. J. T. Foster has been appointed assistant trainmaster on the Northern Pacific, with office at Tacoma, Wash. He has special jurisdiction over the new work which is being done between Tacoma and Seattle.

Mr. A. L. Moler has been appointed superintendent of motive power of the Chicago, Cincinnati & Louisville, with office at Richmond, Ind. Mr. Moler was formerly master mechanic on the Vicksburg, Shreveport & Pacific.

Mr. C. H. Prescott, master mechanic of the Spokane Falls & Northern Railway, at Spokane, Wash., has had his jurisdiction extended as division master mechanic over the Spokane division of the Great Northern Railway.

Mr. Otto E. Walters, who was a short time ago appointed assistant foreman in the boiler shop of the Brooks Works of the American Locomotive Company, has been given the position of foreman of the shop, vice Mr. W. Burns, promoted.

Mr. S. Austin, formerly master mechanic of the Lake Erie & Detroit River Railway, at Walkerville, Ont., has been assigned to other duties. He has been succeeded by Mr. W. K. Christie, who was formerly with the Pere Marquette.

Mr. J. J. Krauss has been appointed master mechanic by the Ouchita & Northwestern Railroad and Louisiana Central Lumber Company, with headquarters at Clarks, La. The mill is one of the largest and most modern plants of its kind in the South.

Mr. L. B. Ferguson, formerly chief draughtsman of the New Orleans & Northeastern, at Meridan, Pa., has been appointed master mechanic of the Vicksburg, Shreveport & Pacific, with headquarters at Monroe, La., vice Mr. A. L. Moler, resigned.

Mr. W. H. Conry, who was recently in charge of the tool room of the Topeka shops of the Atchison, Topeka & Santa Fe, has been appointed superintendent of the engineering laboratory at Purdue University at Lafayette, Ind., vice Mr. M. D. Strout, resigned.

Mr. K. Kiyita, a young Japanese gentleman, who has been making a practical study of American methods at the Baldwin Locomotive Works, in accordance with the policy inaugurated by the Emperor of Japan, was, while at work, seriously injured a few days ago, by being struck by a heavy iron bar.

Mr. R. D. Davis was elected president of the Traveling Engineers' Association at the last annual meeting held in Chicago. Mr. G. W. Wildin was elected first vice president, Mr. J. D. Benjamin was elected second vice-president. Mr. James McDonough, of Galveston, was elected as treasurer of the association.

Mr. Robert J. Gross, second vice-president of the American Locomotive Company, and Charles M. Muchnic, his secretary, arrived in Dunkirk last month from a trip around the world. Mrs. Gross, Miss Gross and Miss Wheeler, who had joined Mr. Gross at Paris, returned with him. As the party passed the First Presbyterian Church the chimes rang out Home, Sweet Home. The chimes were

presented last year by Mr. and Mrs. Gross.

Mr. Albert Ladd Colby, for the past ten years metallurgical engineer of the Bethlehem Steel Company, has accepted the position of assistant to the president of the Orford Copper Company, 74 Broadway, New York, which is one of the constituent companies of the International Nickel Company, who control the nickel output in the United States. Mr. Colby's duties will be chiefly in connection with the manufacture and applications of nickel steel.

Mr. W. H. Elliott, formerly signal engineer on the Chicago, Milwaukee & St. Paul, has been appointed signal engineer on the New York Central & Hudson River Railroad, vice Mr. P. G. Ten Eyck, transferred. His headquarters will be in New York. Mr. Elliott is well known to readers of RAILWAY AND LOCOMOTIVE ENGINEERING. He is the author of the book on signaling called "Block and Interlocking Signals."

Mr. Henry Marquette Lane, mechanical engineer, of Scranton, Pa., has joined the staff of the *Railroad Herald* as mechanical editor. Mr. Lane is a graduate of Perdue University. He has been superintendent of machinery for the Santa Fe coal properties in New Mexico, consulting engineer at Lafayette, Ind., consulting engineer in Michigan, professor in the College of Montana, and professor in the Washington Agricultural College and School of Sciences.

Mr. C. A. Cook, master painter of the Philadelphia, Wilmington & Baltimore, Wilmington, Del., was elected president of the Master Car and Locomotive Painters' Association at its recent meeting in Chicago. Mr. J. F. Lanfersiek, of the Nickel Plate, Columbus, O., was elected first vice-president, Mr. H. M. Butts, of the New York Central, Albany, N. Y., was elected second vice-president, and Mr. Robert McKeon, of Kent, Ohio, was elected secretary of the association.

Mr. George Lindsay, of the Evansville & Terre Haute, was elected president of the National Railroad Blacksmiths' Association at its recent annual meeting at Buffalo, N. Y. Mr. T. F. Keane, of the Ramapo Iron Works, was elected first vice president. Mr. J. W. Riley, of the Pullman Company, was elected second vice-president. Mr. J. W. Riley, of the of the C. H. & D., was elected secretary and treasurer, and Mr. G. H. Williams, of the B. M. Jones Co., of Boston, was elected chemist of the association.

Mr. D. F. Crawford has been appointed general superintendent of motive power of the Pennsylvania lines west of Pittsburgh, with office at Pittsburgh. He has been succeeded as superintendent of motive power of the Northwest system by Mr. T. W. Demarest, with headquarters at Fort Wayne, Ind. Mr. M. Dunn takes the place of Mr. Demarest as superintendent of motive power of the Southwest system, at Columbus, O. Mr. S. W. Miller succeeds Mr. Dunn as master mechanic of the shops at Columbus, and Mr. G. C. Bishop takes Mr. Miller's place as master mechanic at Logansport, Ind.

Mr. Charles S. Mellen, who is about to be elected president of the New York, New Haven & Hartford Railroad, will have an opportunity to distinguish himself as a manager which few men have enjoyed. The railroad he takes charge of is the only artery of travel between Boston and New York; it is the channel over which travel between New England and all States south of the Hudson River has to pass, a route of travel with illimitable possibilities. The property has been managed in a ridiculous fashion, the convenience of the public being the last thing considered. The trains are slow and run at long intervals, while the eating accommodation is twenty-five years behind the times. The business has been deliberately managed to force passengers to travel by the water lines belonging to the company. Mr. Morgan and Mr. Rockefeller have combined their forces to push out President Hall and invite President Mellen in. If the latter will reform the N. Y., N. H. & H. to provide comforts and conveniences similar to those given by the Pennsylvania or the New York Central, the increase in business will vindicate the change of management.

Mr. Augustus C. Home retired to-day from the post of assistant master mechanic of the Louisville & Nashville Railroad and master mechanic of the Cumberland Valley division, and began his duties as general manager of the Louisville & Atlantic Railroad, with headquarters in Versailles, Ky. Mr. Hone was graduated from the Rensselaer Polytechnic Institute of Troy, N. Y., in 1890. He first entered the railroad business in 1898, when he went with the Evansville & Terre Haute Railroad as civil engineer. Mr. Hone forged ahead quickly, and in August, 1899, became superintendent of motive power for the road. He was appointed general manager of the road in January, 1901. One year later he entered the service of the Louisville & Nashville as assistant master mechanic of the local shops. He attracted the attention of the higher officials, and soon was made master mechanic of the Cumberland Valley division. Mr. Hone filled both positions acceptably. This is another of the many cases now on record in which mechanical department officers are advanced to responsible positions in the operating department.

The voice of Time cries to man, Advance!—*The Chimes.*

Rumors have been current that President Duntley, of the Chicago Pneumatic Tool Company, is about to resign and that Mr. C. M. Schwab would take his place. Mr. Schwab has invested largely in Chicago Pneumatic Tool Company stock, but we are authorized to say that there is no truth in the rumor of the likelihood of his becoming president.

Obituary.

Nathan Washburn, the inventor of the Washburn car wheel, died recently in Stafford Springs, Conn. He was eighty-five years old. Mr. Washburn invented a process for puddling steel whereby he made a gun iron superior to the English manufacture. In 1876 he began the manufacture of steel locomotives at his Worcester plant, and he was the first man to put an enduring steel tire on a locomotive.

Union Switch and Signal Company's Installation.

Two recent and important contracts by the Union Switch & Signal Company are those for the Interborough Rapid Transit Company (Subway), of New York, and the North Shore Railway of California.

The Westinghouse Electro-Pneumatic system is to be installed on the first named, but a new feature is to be introduced, that of using alternating current. It is obvious that the use of track circuits on third-rail roads, where the rails are used for the return circuit, and at the same time for the signaling circuit, introduces what may be serious complications. In order to avoid these difficulties, the signals will be controlled by alternating current, through relays that are sensitive to alternating current only, and which will not be affected by the direct current used for train service in the subway.

On the North Shore Railway, which runs about thirty miles north from Sausalito, Cal., across the bay from San Francisco, the electric semaphore system of automatic block signals is to be used with a track circuit. This being a high tension third-rail electric road, alternating current will be used for the signal system.

The gross earnings of the Chicago Great Western Railway (Maple Leaf route) for the fourth week of August, 1903, shows an increase of $26,923.79 over the corresponding week of last year. Total increase from the beginning of the fiscal year, $198,040.00.

A series of exhaustive tests were made recently with a three-furnace oil-burning locomotive on the California Southern divisions of the Santa Fe. The performance of the engine was found to be about as good as that of fire box engines, but no better.

The Proper Lubrication of Piston Valves and Cylinders.

The matter of oiling piston valves is practically a new one, but a very important one, and as the piston valve has come to stay for a time at least, I believe some method other than the method of oiling the slide valve is necessary. With this fact in view, I have made a test on this matter and am well pleased with the results obtained. Beyond any doubt a piston valve needs less oil than a slide valve, owing to the fact that it is a perfectly balanced valve or nearly so. I have discovered that a piston valve may be receiving a sufficient amount of oil while the cylinders are not receiving a sufficient amount, and that when the cylinders are getting oil enough the valves are using more oil than is necessary. On April 1, 1903, engine 290, a class R-1, with 21x26 in. cylinders, was being reported at every terminal that left cylinder was groaning badly. On examination we found that the cylinder was not receiving oil enough as it showed cutting very seriously. It was necessary to hold the engine in for some light work, and I had a ⅜ in. copper pipe connected direct from the top and center of the cylinder to the bottom of elbow of oil pipe, where it connects to steam channel and cylinder saddle. The elbow having a ball valve in the oil passageway, which was seated by steam pressure when engine was working steam, thus closing the passage of oil to valve and allowing oil to flow direct to cylinder; but when engine was not working steam, the ball valve would be unseated and the oil flow direct to the valve. Thus the cylinder would get oil direct from the lubricator while working steam and the valve would get oil from the exhaust while the engine was working steam and from lubricator when engine was not working steam. After putting this device on we had no further complaint of cylinder groaning, and after one week's time we applied the device to the right cylinder of this engine. Soon after this engine left the Iowa division and a letter from the master mechanic of the division on which the engine is now running, shows the cylinders and valves chamber heads have not been off up to August 1.

We also had a class D, high speed passenger engine with cylinders 21 by 26 equipped in like manner April 1, on account of the engine continually groaning and laboring hard. The cylinders of this engine at the time of application showed a dark dull lead color and were badly scratched, but after the device had been in use during the time the engine made 12,000 miles, we took the cylinder heads off and found cylinders as bright as a mirror and valves showed that they had not suffered for want of lubrication. This engine has now made over 50,000 miles since the device was put on without her cylinders groaning and without a renewing of cylinder packing.

ROAD FOREMAN OF ENGINES.

Omaha Express Engine.

Annexed is a photograph of the big twelve-wheel new engines, now being put in service to pull the North-Western Limited to Chicago. These engines have drivers 75 inches in diameter with cylinders 21 inches in diameter by 28 inch stroke. Weight of engine is 192,000 pounds, of which 130,000 pounds are on the drivers, 32,000 on trailers and 30,000 pounds on trucks. Boiler is 64 inches in diameter, and has 275 flues, each flue is 2¼ inches in diameter and 20 feet long. Fire box is 90 inches long by 75 inches wide, with a total heating surface of 3,425 square feet. Wheel base of engine is 32 feet 4 inches; of engine and tender, 59 feet 6 inches, and total length of engine and tender is 72 feet. The tender carries twelve tons of coal and 6,200 gallons of water. Total weight of engine and tender is 242,000 pounds, and, including coal and water, 318,000 pounds.

OMAHA 4-6-2 EXPRESS ENGINE

These engines are of the new Pacific or 4-6-2 type, and are capable of maintaining an unusually high rate of speed, and especially designed for getting up speed quickly in leaving stations.

The total weight of the North-Western Limited Chicago Train pulled by these engines, not including engine, is about 410 tons.

Center Plates and Side Bearings.

Some interesting results of experiments were brought out by the Master Car Builders' committee on Side Bearings and Center Plates, which were presented to the Association at its recent meeting at Saratoga.

The least flange resistance was secured by the use of center plates made of chilled cast iron with flat rubbing surfaces. Several sizes of the latter plates were made with rubbing surfaces ranging from [illegible] sq. in. down to [illegible] sq. in. [illegible] from all the [illegible] sizes, but the [illegible] plate with an area of 86.738 sq. in. and with no lubrication, gave the best general results, and a flat plate of that description was therefore recommended by the committee as the standard form of center plate for the M. C. B. Association to adopt.

Ball bearing center plates were also made the subject of experiment and the results obtained were such as to establish the conclusion that flange friction would be much reduced by their use. The committee suggested that a number of cars on various roads should be equipped with ball bearing center plates in order to test the durability of the latter.

Some unexpected results of lubricating center plates appeared during the tests. They were, as the committee say, "startling exceptions" to the general rule that lubrication reduces friction. A Kloh's plate, smooth and fitted, gave, when lubricated, a higher flange pressure than the dry plate. Another feature was the rapid, and at times, the complete disappearance of the lubricant from the points of contact under comparatively low pressures.

A number of side bearings were tried, but were not tested completely, as the apparatus used with the center plates would have had to undergo some modifications which the time at disposal of the committee would not permit.

In busy places, where each man has an object of his own, and feels assured that every man has his, his character and purpose are written broadly in his face.—*Old Curiosity Shop.*

New Plainer Type Milling Machine.

This machine is built from new designs and new patterns and is of very heavy construction. It is designed for strength, rigidity and power, with special provisions for ease of operation and the demands of modern milling machine practice. It is built by the Becker-Brainard Milling Machine Company, of Hyde Park, Mass. The machine is 32x26 ins. by 10 ft., and is of the plainer type of milling machine.

The spindle is made of hammered crucible steel, 5 ins. in diameter, has a threaded nose and runs in self-centering bronze boxes with a nut and check nut to compensate for wear. The spindle carrier is heavy and is held firmly to the upright by long gibs. It is elevated by a screw with adjustable dials graduated to thousandths of an inch and has a counterbalance for ease of operation. There are 20 changes of speed for the cutter spindle obtained by gearing in the main driving cone, operated by clutch and lever, so that all changes can be made instantly.

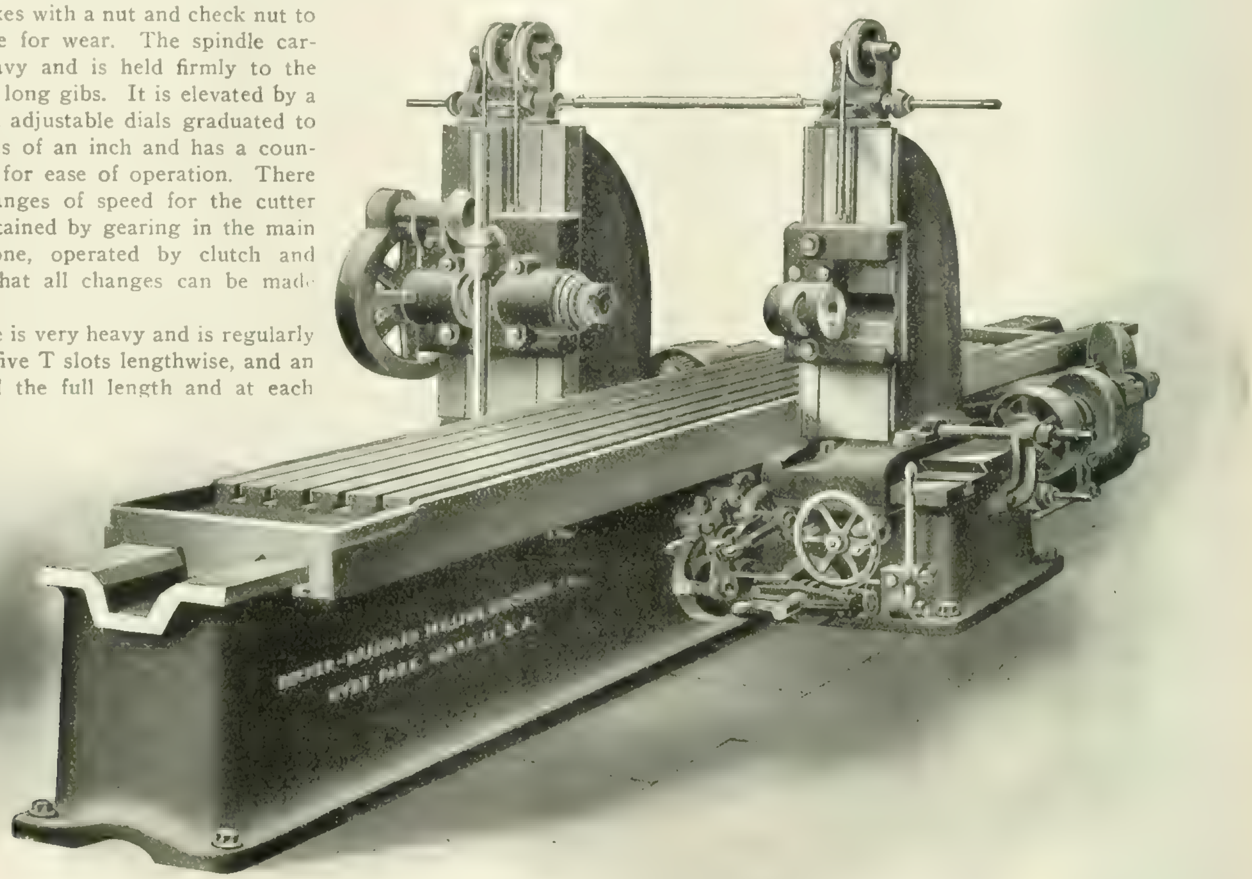
The table is very heavy and is regularly built with five T slots lengthwise, and an oil channel the full length and at each end. It travels on flat ways securely gibbed and has a quick return operated by power from a separate countershaft. It can also be moved by the usual hand wheel.

The feed of the table is directly operated through gearing from the spindle at ratios of 13½ and 27 to 1 by 5 in. belt on a 5-step cone, the diameter of which is 23 ins. on the largest step and 13 ins. on the smallest, giving a range of feed through eight changes from 3-64 to ⅜ in. These changes of feed can be made instantly by means of a lever, without stopping the machine.

The head may be adjusted in either from either side of the machine, so that it is not necessary to take the cutters off the arbor in order to change their position in relation to the work.

The bed is extra deep, extending to the floor and making a solid foundation. It is securely braced by heavy cross girders which are evenly spaced throughout the entire length. The bed can be made any length desired.

The specifications are as follows: Working surface of platen, 120 ins. by 26 ins.; length of bed size of platen inside oil pockets, 120 ins. by 26 ins.; longitudinal feed, automatic in both directions, 120 ins.; greatest distance from center of spindle to table, 28 ins.; least distance from center of spindle to table, 2 ins.; greatest distance from end of spindle to center of table, 16⅜ ins.; least distance from end of spindle to center of table, 6¾ ins.; greatest distance from end of spindle to tail stock pin, 37 ins.; least distance from end of spindle to tail of stock pin, 17 ins.; net weight, 25,000 pounds.



BECKER-BRAINARD PLAINER TYPE MILLING MACHINE.

A good point was brought out at the meeting of the Master Car and Locomotive Painters' Association, recently held in Chicago. In two of the papers read it was pointed out that the paint on steel cars is often destroyed by what the M. C. B. rules would probably call "unfair usage." One way in which the protective covering of the cars is knocked off is by blows delivered by iron bars or other hard substances which dent the surface. The objet of this rough usage is no doubt to loosen frozen coal or ore, but the effect upon the paint is disastrous. Another way in which the paint is removed in large quantities is by loading hot iron cinders and ashes. This has the effect of melting the pigment, and the unloading process carries it off. A good way to minimize this evil would be to set apart certain cars for this particular service and not load hot material promiscuously into steel cars.

"Tie Preserving Cylinders for the Alamosa-Colorado plant of the Denver & Rio Grande Railroad have just been shipped from the Fraser & Chalmers Works of the Allis-Chalmers Company, making thirty-one cylinders which have been shipped by this company for that purpose during recent years. The three cylinders for the above named company are of the average size, 6 feet diameter, by 110 feet long. The plant was designed by Mr. Samuel M. Rowe, member A. S. C. E., Chicago, Ill., and is intended for treatment of ties by means of the Wellhouse process."

A man never knows what he can do till he tries.—*Pickwick Papers.*

Proceedings of Traveling Engineers' Convention.

(*Continued from Page 470.*)

not perceptible when double nozzles are used.

Mr. J. B. Johnson, C., M. & St. P., said they use the baffle plate set back of the nozzle stand, and they have trouble with the smoke boxes filling up with cinders.

Mr. W. E. Widgeon, T. H. & I., said that the extension front end was originally intended as a receptacle for cinders. When the diaphragm is extended in front of the nozzle stand the front end is self cleaning.

Mr. Stevens, on the Union Pacific, we have five or six different styles of front ends. We have no trouble in keeping the front ends clean with the deflecting plate back of the nozzle. Our superintendent of motive power sent out a question asking if maintaining cinder chutes was necessary? We are now removing the cinder hoppers as fast as the engines pass through the shops.

Mr. G. H. Horton, Soo Line, said they had changed the diaphragm of some passenger engines from the back to the front of the nozzle for the purpose of making them clean the front end, and it worked all right. They were not so successful in changing a compound engine which deposited cinders on the bed plate to an alarming extent. They had taken out the petticoat pipe without improving matters.

Mr. Johnson, C., M. & St. P., said that when first they adopted the extension front, they used a bed plate up to the exhaust pipe. They afterwards put netting in place of the bed plate and got better results in steaming. He wanted to know if those using self-cleaning front ends were troubled with sparks and dirt thrown upon the train.

Mr. Johnson answered that he recently drafted two new engines for the M. & O. that have a straight draft pipe, single nozzle with a draft plate extending in front of the exhaust pipe, which is adjusted at a height of 17 inches. The distance between petticoat pipe and base of stack is 3½ inches. These front ends clean themselves almost entirely. The sparks seem to be pulverized before they are thrown out and there is little fire in them. He did not believe that a vacuum could be created in the smoke box unless the exhaust steam filled the stack.

Mr. McBain said that if the steam filled the stack, he could not see how the gases could get through. Some one having suggested that the action was the same as that of the injector, Mr. McBain replied that the cases were different, as two permanent gases had to pass through the stack.

Mr. George W. Wildin, Central Railroad of New Jersey, asked if he understood Mr. McBain to say that the length of stack did not affect the steaming of an engine.

Mr. McBain answered that he had not found it made any difference.

Mr. Angus Sinclair, RAILWAY AND LOCOMOTIVE ENGINEERING, referred to the discoveries about draft appliances made by Mr. Robert Quayle, and a committee of which he was chairman for the Master Mechanics' Association in 1896. These demonstrated beyond question that the plunger theory of the exhaust jet is a fallacy. The Master Mechanics' Association have devoted great attention to the investigation of draft appliances, and their discoveries ought to guide those working in the same field. He directed attention to the fact that people are undertaking every year the investigation of subjects that have been thoroughly investigated by others, and that the new investigators are frequently ignorant of anything having been done in the same line before. He made a plea for the study of engineering literature by would-be inventors and investigators. He strongly commended the annual reports of the Master Mechanics' Association for the valuable information they contain.

Mr. Wildin claimed that the draft on the fire was created by the action of induced currents.

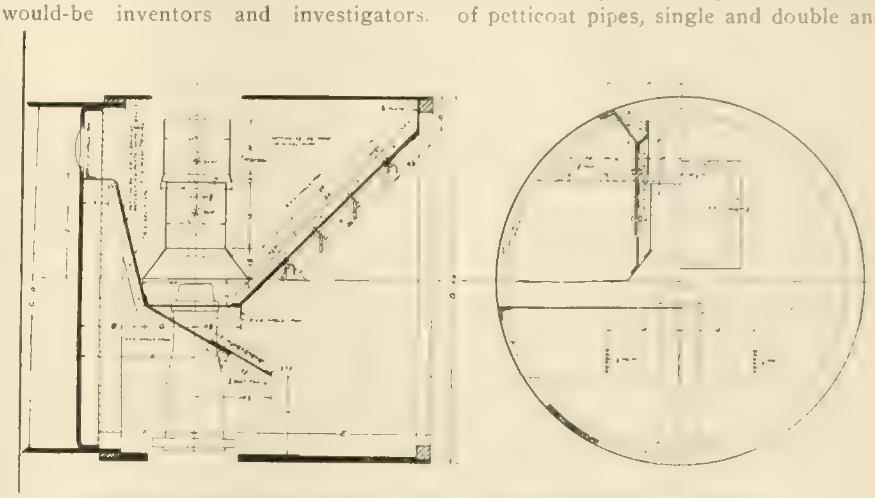
Mr. Johnson insisted that the induced currents were due to the piston-like action of the exhaust steam in the stack.

Mr. F. Roesch, Chicago & Alton, believed that a successful front end must be designed to suit the conditions of fuel and service. One man may want his diaphragm ahead of the nozzle, and another behind it, and both get good results. He had been on a road where they changed the S. M. P. with every moon. Each S. M. P. had his own front end and they all steamed. Believed that the quality of the coal has more to do with steam than the design of front end. Did not believe that the deflecting plate has any great effect on the action of draft on the fire. Principal trouble with deflecting plate is, that it is set too close to the flues at the top, with the result that draft through the upper flues is restricted. Owing to obstruction caused by the diaphragm, nozzles have frequently to be reduced to create velocity of draft. Believed the Master Mechanics' front end is all right as a general design and that it can be adapted to our needs. Had no faith in adopting what might be called a Traveling Engineers' front end. Thought a double lift pipe a delusion and a snare. They cannot be kept in line. Cited case where new engines came with double lift pipe and they never steamed until a single pipe was substituted.

Mr. Robinson agreed with Mr. Roesch concerning the little influence the position of the draft pipe exercised on the fire.

Mr. Roddy, Santa Fe, believed that the draft plate exerted influence on the fire of deep fire-box engine. With certain big engines he found that steaming was improved by removing altogether the deflector plate. They have all kinds of petticoat pipes, single and double and simple and compound, and he expressed the opinion that the petticoat pipe was a delusion and a snare from beginning to end. He called it the result of a pipe dream. If the steam jet does not fill the stack, what do we want a petticoat pipe for? To prevent the gases from escaping out of the stack? He related numerous facts of experience that reflected against the petticoat pipe, and made the assertion that the most useful place for that appliance was at the back of the round house: I have got fifty of these pipes lined up back of the round house and the engines are steaming well.

Mr. Frank O. Miller, C., H. & D., defended the diaphragm and the petticoat pipe. He had converted a poor steamer into a good steaming engine by applying a petticoat pipe. With a shallow fire-box engine he was able to adjust the diaphragm plate to draw every bit of fuel to the front of the fire box or vice versa. Had been taught that the lifting pipe and the diaphragm plate



MASTER MECHANICS' FRONT END ON THE MICHIGAN CENTRAL.

could be adjusted to make an engine do its best in steam generating, and he had found that to be true.

Mr. E. R. Webb, Michigan Central, said they were not troubled with report of engines not steaming, and they use the lift pipe. He believed that instead of throwing away the deflector pipe Mr. Roesch ought to have changed the fireman.

Mr. Stewart, Union Pacific, said: "On our road we have got a class of engines with a very short stack; I think they are about 20 inches. They used them for a little while, but the engineers did not think they steamed as well as they ought to because the stack was too short, and one or two of them got a sleeve and put on the top and raised the top about 15 inches, and it made an improvement, in their mind. They would be going along up an eighty-foot grade, the exhaust would be pretty heavy and out would go the sleeve. They wouldn't know it for two or three trips, but as soon as they found it out, they had to have a new sleeve because the engine did not steam well.

"As Mr. Roesch said awhile ago, we changed coal on the Union Pacific, and I was sent down there to assist in adjusting the engine to the new coal. The Denver & Rio Grande were using the same coal and they had a bushing in their stack. The first thing the firemen began to complain of was that they had no bushing in that stack like the Rio Grande engines, with that they would steam all right. I asked them what they wanted it for, and they said to make the stack longer. I asked them why they could not have it in the front and extend it down instead of up. That wouldn't do. They wanted it on top.

"At that time we had some trouble, a strike on the road, and a good deal to contend with, and I put a bushing in one or two stacks and ran the engines myself. I could not see that it made any difference. I took the bushing out, and I think the length of the stack, as my friend Roddy says about the petticoat pipe, is a pipe dream in a good many instances."

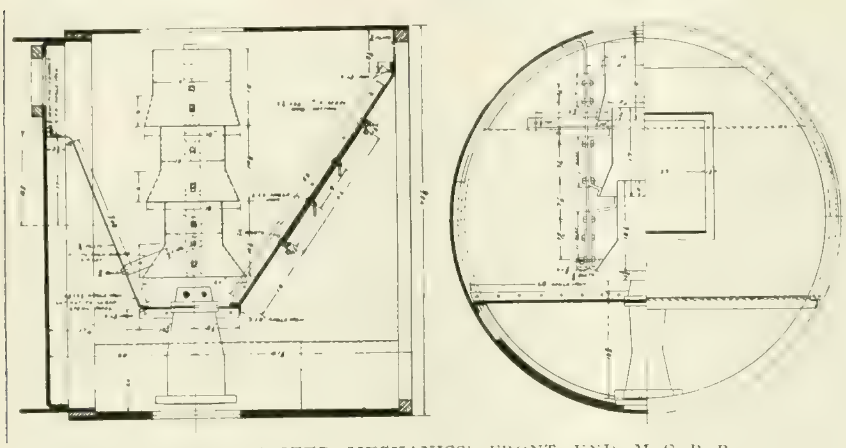
Mr. McBain protested strongly against the lift pipe being called a delusion and a snare. A man from one corner of the country comes and applies that expression to a device in popular use. It seems to cast a reflection on all the superintendents of motive power in the country.

Mr. Roddy said that the mechanical men of this country are going wrong, for to-day they are building engines with 3,700 feet of heating surface to supply 17-inch cylinders.

Mr. Brown mentioned that the D., L. & W. had adopted an 18-inch stack and all engines were being equipped with that size.

Mr. Benjamin, Chicago & Northwestern, mentioned that they had tried on an engine a downward extension of the smoke stack. That did fairly well, but it soon wore out and was removed. After that they applied an ordinary lift pipe and the engine steamed better.

Mr. Buckbee drew attention to the fact that great changes have been made on locomotives since the Master Mechanics' experiments of 1896 were carried out. The changes call for modifications of the proportions found best by the Master Mechanics' Committee. He thought that Mr. Roddy was probably right in throwing out the lift pipes, thereby removing obstructions to the escaping gases.



MODIFIED MASTER MECHANICS' FRONT END—M. C. R. R.

Mr. Buckbee believed that enlarging of stack diameter was made necessary by the increase of grate area.

Mr. Conger raised the question, does an engine with a large grate area generate more fuel gases than one with a smaller grate area?

Mr. Bentley thought they were making a mistake who were trying to get rid of the unconsumed gases. They put in the petticoat pipe to retain these gases.

Mr. Roesch wanted to retain the unconsumed gases in the fire box as long as possible, but he favored letting them escape freely when they reached the smoke stack.

Mr. McBain: After some consolidation engines we received had fairly demonstrated to every person concerned that they would not boil water satisfactorily, something had to be done to get them to do that. The first move that was made was to apply a vacuum gauge, one in front and one behind the diaphragm plate, and a trip was made over the road. The reading of that test showed a 2½-inch vacuum behind the plate and a 4-inch vacuum in front of the plate. Those engines had a diaphragm plate coming down the usual slant, then over horizontally six inches in front of the nozzle, then down perpendicularly until about 14 or 16 inches of the bottom of the arch. We proceeded to experiment to produce better results. The first was to take out all the diaphragm arrangement except that extending down behind the nozzle. In place of the plate a netting was put in from the front end back. The result was that the vacuum was practically equalized from the front to behind the plate and diminished slightly in both places. The engine had a 14-inch choke stack on. On the return trip by keeping the blower on full the engine was kept fairly hot and did good work. The engines came with a 14-inch choke stack extended 15 inches into the smoke arch on the single section petticoat pipe, fitting tightly into the bottom of that so that all the outlet for gases there was, was right under the bottom of the pipe, directly over the exhaust tip. The next change made, after changing the diaphragm plate, was that the smoke stack was taken off and an ordinary straight stack 18 inches in diameter and 26 inches long was put on in place of it, and a two-section draft pipe, having sections twelve and fourteen inches in diameter, respectively. Then we went out on the road and had a free steamer. But, to the consternation of the Mechanical Engineer, who was riding on the engine at the time, and myself, the vacuum was lower than ever. At any time when the engine was working along, drawing full tonnage, at little better than half cut off, probably at a speed of 25 or 30 miles per hour, the vacuum would not exceed 1¾ inches. Yet the engine steamed splendidly all the time. Instead of increasing the draft and hurrying the unconsumed gases out of the engine, is it not evident that the opposite was the effect? The combustion was slowed up and the disintegration of the coal was lessened and the gases were liberated more slowly and more thoroughly. It is a fact that the vacuum is only about 1¾ inches now on those engines when they are working full capacity.

Mr. Hurley: I might say that we received a number of those engines with a 14-inch stack and we increased them to 18 inches with good results. They were lighter on fuel and better steamers. We went a little further. We went to 23

inches, and I am inclined to think we exceeded the limit. The engine is not doing as well. We have got one 23 for experiment. She does very well with a heavy train and fast run, but when she has a light train and slow time she doesn't make steam.

Mr. Wallace, Chicago & Northwestern, I would just like to say a word to the remarks that Mr. Sinclair made, where he spoke about changing the front end to meet the conditions you find in service. If he had said "Let it alone when you get it there," he would have finished it. That is the trouble. When the engine is properly drafted to give the best results, the first thing we know some one reports her not steaming, and a change is made.

Mr. Gillett, Norfolk & Western, was struck with the conflict of opinion about the front end. He favored progress. They had abandoned the lift pipe and got on well without it. He directed attention to the fire claims that railroad companies have to pay, and considered it the duty of the Association to provide the best front end they could find, and he recommended one designed by a medical doctor which he considered nearly perfect.

After some desultory discussion, Mr. Wallace proposed the following.

Resolved, That we, the Traveling Engineers' Association, recommend no special or definite front end arrangement at this time, but do recommend that the facts developed by the Master Mechanics' Association and by Professor Goss, of Purdue University, be made our basis for future work and research; and, further, we believe the greater part of the difficulties experienced in service are due more to lack of system in keeping the appliances adjusted so as to give the best results than to the mechanism itself.

Mr. Conger: I move the adoption of that resolution just read.

Carried, and discussion closed.

DISCUSSION OF MR. BEARDSLEY'S PAPER ON THE CARE AND HANDLING OF THE COMPOUND LOCOMOTIVE.

At the conclusion of his paper Mr. Beardsley requested President Meadows to call upon Mr. McCarroll, of the Baldwin Locomotive Works, to say something on the four Vauclain balanced compounds now on the Santa Fe. Mr. McCarroll responded by reading a paper as follows:

Four compound locomotives of the four-cylinder balanced type have been recently built for the Atchison, Topeka & Santa Fe Railroad, and are in very successful operation on their line in the heavy fast passenger service of that system.

The following advantages are claimed for this type of locomotive over the ordinary type of locomotives: 1. Practically a perfect balanced locomotive. 2. Lightness of reciprocating parts. 3. Smoothness in running. 4. Quickness in starting and handling trains. 5. Reduction of injury to track and permanent way structures. 6. The usual advantages claimed for compound locomotives (economy in fuel and water).

In consideration of these advantages of the locomotives, a knowledge of the general design is necessary. The most striking feature, of course, is the employment of crank axles with inside connection to low pressure cylinders. The cylinders are set in direct opposition to their respective low pressure cylinders, which are located outside the frames and connected to the driving wheels by crank pins in the usual manner, or, in other words, a high pressure cylinder is connected to its low pressure cylinder with a connection at 180°, but the high pressure cylinder on one side of the engine is coupled to the high pressure cylinder on the other side with its connection at 90° or quartered in the usual manner. Similarly, the low pressure cylinders on opposite sides of the engine are quartered with each other. This arrangement distributes the power at four quarters of the driving mechanism instead of at two quarters, which is the usual method employed on ordinary locomotives.

With this short explanation we may proceed to the individual advantages:

1. Practically a perfect wheel balance is obtained by opposing a high pressure cylinder to a low pressure cylinder at 180°. The individual weights of the parts composing the driving mechanism are thus made to balance each other. They are so designed that the weight effect of the interior parts exactly counterbalances the like effect of the exterior parts. The revolving weights on the coupled wheels are balanced by counter-weights in the usual manner so that their vertical efforts are eliminated. The reciprocating parts by moving in opposite directions at the same time effectively balance each other. The only discrepancy being the difference in weight between the inside and outside reciprocating parts which is usually too slight to require any serious consideration. In this matter of unbalanced reciprocating parts it is well to note that the common practice of counterbalancing ordinary locomotives is to consider only two-thirds of their weight and to add this proportion to a revolving balance, which at the best is only an approximate method of absorbing their effects. The reciprocating motion can never be correctly balanced by the revolving motion, as their effects are different at all points in their travel. In the balanced compound locomotives the reciprocating parts are always balanced by other reciprocating parts and never by their revolving parts. The slight error in balance due to the difference between the internal and external weights is never so far from a theoretical balance as is the ordinary method of balancing a proportion of reciprocating parts by counterweight having an entirely different motion and effect.

2. The balanced compound locomotive offers splendid opportunity for lightness of reciprocating parts, as the distribution of power is on four different quarters of the driving mechanism instead of on two points only, as is usual on locomotives of all other types. This reasoning is obvious and is simply a matter of mental arithmetic for rough explanation by the way of 1 divided by 2 equals ½, and 1 divided by 4 equals ¼. The unit, of course, representing the total power developed by the cylinders for distribution to the driving mechanism.

3. Smoothness of running is of course the result of equal distribution of power (at four quarters as just explained) as well as in the perfection of balance previously mentioned. This feature will make itself apparent to engine men very early in their experience on running such a locomotive.

4. Quickness in starting and hauling trains can also be attributed to the equal power distribution, and the consequent fact that at least two cylinders are always effective for starting instead of but one, which latter condition is often the case in locomotives of ordinary types.

5. A reduction of injury to track and permanent way structures by the perfect balancing and power distribution with consequent ease of running should be no mean factor in the success of this type of locomotive. Much has been written on the injurious effect of the "hammer blow," and to those familiar with this feature of practical railroading, the advantages of a machine which practically eliminates all vertical blows on the rail will be quite apparent.

6. We may safely pass over the usual advantages claimed for all types of compound locomotives. The saving of fuel and water has been so universally acknowledged that no attention need be given to this question. With the advantages of this system of balancing in addition to those ordinarily obtained by compounding, we may safely assert that the Vauclain Balanced Compound Locomotive is the coming engine for developing high speeds and power and minimizing risk of injury to permenent way structures.

I have a photograph here of the effect of the hammer blow on the rail. I would like you gentlemen to look at it. I do not believe any of you ever saw the effect of it as developed here. I do not want to lose this, but I will gladly pass it around.

Mr. Stewart, of the Union Pacific, speaking of the Vauclain Compound, said that road had about 140 or 150 of

them, and if given a chance, a good compound and an average simple engine, the U. P. engineers would take the compound every time. He said his experience had been that if the round house does not keep up its end, the compound is not much good very long. He also pointed out that it was possible to get home with a compound with something gone wrong a good deal better than with a simple engine in the same condition. He did not think that the U. P. compounds are any lighter on water than the simple engines when cutting off at say 7 or 8 ins., but they are lighter on fuel and the fire box lasts longer, and they are easier on flues. With heavy consolidation compounds the weight of the reciprocating parts causes the imperceptible slip when the crank pin is on the bottom quarter to wear the wheels out of round before the engine is ready for the shop. In that case new tires are applied and the engine kept in service. The system of monthly inspection of piston packing is in vogue with beneficial results. The wear of the heads are recorded when the piston packing is examined. The men are not allowed to pull cars over the road with the starting valve open. He did not see much use in cylinder cocks in the high pressure cylinders, but he had recommended that they put in test plugs on the left side, same as the right, to aid the engineer in locating his troubles and to assist the round house people in doing their work quickly.

Mr. Roesch, of the C. & A., said that he saw no necessity of splitting hairs on this subject. He did not see why an ordinary engineer or an average engineer should be asked to designate what particular ring in 16 valve rings was broken, and he believed that this hair-splitting business and making fun of a man that cannot detect exactly what ring is broken had as much to do with getting the compound into disrepute as anything else. If an engineer comes in and reports "valve ring broken on left side," that ought to be sufficient, he ought not to be required to say ring No. 1 or ring No. 8. With rings 1 or 8 broken we will have three equal exhausts and one unequal one. If we, as traveling engineers or road foremen of engines, would try to instruct our men a little bit better in locating the principal defects on compound engines, and not try to make fun of them about it, we would get along much better and the compound engine would get more credit than it is getting to-day.

Mr. Beardsley said in answer to a question from Mr. Buckbee as to what defects in design have been most noticed in the Vauclain compound and the tandem on his system: "While this paper is not intended to take in the design of a locomotive, and I am not a locomotive designer, I do not suppose there are very many of us here that have not found there are a few defects, anyway. I might mention a few. The first is that a few years ago we had a compound locomotive, turned out with a 15½ in. high pressure cylinder and a 12 in. valve. Then we had a 15 in. cylinder with an 11½ in. valve. Then we had a 17 in. This is the high pressure cylinder I am speaking of. Then we had a 17 in. cylinder with a 15 in. valve, and now we have got a 15 in. high pressure cylinder with a 15 in. valve, that is, I mean, the diameter of the valve. The balanced or twentieth century engines that have now come to us have a 15 in. high pressure cylinder and a 15 in. valve, which I claim is one step in the right direction so far as the design is concerned. That is one of them, and I don't know but the most important one, according to my ideas. Of course with this same engine we have got a lighter engine or an engine designed to handle the train. These engines should and are handling ten, twelve and even fourteen cars at a speed of 60 miles an hour, across what we call level country, where before that we had on the same runs a 17 in. cylinder on an engine weighing a great deal more. I cannot give you the exact figures.

"Those two points in the design are foremost in my mind right now. One is the size of the valve; the other is, if you please, the size of the engine, being designed for the train that you want her to pull. There are a great many others. There was just one thought came to my mind. In fact, Mr. Quayle mentioned it, that I should have included in answering your question. That is, the inside and outside admission valve. I think they have made another improvement, which is an inside admission valve."

Mr. Buckbee said: "I have seen different sections of the country, defects in the general design of the engines often charged to the compound feature, such as light frames, limited heating surface and grate area, etc. Other times where engines were too light for the service. I asked this question for the purpose of asking whether Mr. Beardsley had noticed such things as that with the engines he has on his system."

Mr. Beardsley replied: "Certainly we have. We have got engines that have got too much cylinder for the size of the wheel. They have not got too much cylinder for the size of their boiler, but they have too much for the size of the wheel. The consequence is we have a very slippery engine, an engine that wears the tires very fast. I have also noticed, as you say, the broken frame. I have found no reason so far to charge a broken frame to the compound feature of the engine, because we always had broken frames; probably always will have, but locomotive designers as well as builders are getting more familiar every day—I can see it—with these things, and the consequence is they are improving them; at least I think so."

Speaking of the compound, Mr. Webb, of the Michigan Central, said: "You cannot operate the engine, kick it out into service as you would a wheelbarrow, and in the end, at thirty days or ninety days or a year have as good an engine as you would a wheelbarrow. You are getting greater service from the engine; you must give it greater care. The fact that many of the roads operating compound engines are not having the success which they expected need not be laid entirely to the door of the locomotive engineer. If he is not doing as well as he should do, in a great measure the failure rests upon the traveling engineer, the road foreman of engines and the master mechanic as well. The engineer if he is to do good service must be educated."

Mr. Crandall, of the New York Central, Western division, said there were about 70 cross compounds on the system, and 30 tandems. They handle 70 to 85, possibly as high as 90 loaded cars. The train is 3,000 tons. He said: "We find the wear on the knuckle pins and the side rods is greater on the compound than on our simple engines. We have a good many leaks around the front end, more than on the simple engines, in view of the fact that there are more places to leak." The tandem compound, in his opinion, was not as good an engine as the cross compound. Some he referred to were rated at 3,300 tons, but they did not handle 3,300 tons nearly as well as the cross compounds.

Mr. Conger, of the International Correspondence School, said: "I would like just to ask one question. On the Colorado Midland or Colorado & Southern compound I saw that the exhaust from the air pump goes to the by-pass valve at the cylinders, so that the exhaust steam from the pump when the engine is shut off goes in there and helps them about drifting. I should like some member to explain a little about that. Probably Mr. Roesch can tell us about that, whether it is satisfactory or not?"

Mr. Roesch, in replying, said: "At the time I was connected with the Colorado & Southern we did not have the air pump exhaust into the compound engines. We had at that time some tandem compounds, but these tandem compounds were equipped with an auxiliary throttle which was opened when the engine was drifting. We, however, used the air pump exhaust in the simple engine. The results were fairly satisfactory."

Mr. Corbett said: "We have about 28 of the cross compounds on the Michigan Central. They are rated for 2,000 tons on a grade of about 20 feet to the mile. They make a trip of 150 miles with about eight or nine tons of coal. No trouble

with the cylinder packing breaking. Occasionally we find the rings in the piston valve broken. We very frequently make the run of 103 miles without stopping, scoop water twice. We are troubled but very little with running warm and all in all I think the cross compound are a success on the Michigan Central."

Mr. Richardson (B. & O.) spoke briefly as follows: "We have a few of all kinds, but I think the engine that we are looking for is the one that will earn the company the most money for the least repairs, goes in and out without much trouble. I have listened to these gentlemen telling about the big trains they pull with the compound engine. Won't the simple engine with the same tractive power do just as well? Come in and go out again and do it finely and do it with less work? We have compound engines that we have made simple. While they were compounds they went in twice for machinery repairs and for one set of flues. Now they go in twice for flues for one set of machinery repairs. We have some cross compounds that are doing good service, but we don't know but what a simple of the same tractive power would do as well."

Mr. Webb, when asked for the oil record of the compound engines making in the neighborhood of 4,500 miles a month, said 75 miles is allowed for valve oil, and 24 for engine oil, and the work was done on this allowance.

The discussion closed by Mr. Beardsley extending an invitation to the members of the association to visit the Eighteenth street round house of the Santa Fe Railway in Chicago, and see some compounds which were lately received on that road.

CARE AND HANDLING OF THE COMPOUND LOCOMOTIVE.

The Traveling Engineers' Association at their recent annual meeting in Chicago, listened to a paper read by Mr. A. L. Beardsley, of the A. T. & S. F. on Care and Handling of the Compound Locomotive. The speaker laid down the principle at the outset that before the men whose duty it is to care for and handle the machine can get good results they must first have an engine designed and built for the service expected. He put in a plea for the proper use of the starting valve. He said "the fact that this device adds to the tractive force of the locomotive is often taken advantage of and the engine is overloaded, causing the starting valve to be used and the engine to be run 'simple,' which is very hard on any compound." There is no question but that the economical point at which to work a compound locomotive is in one-half stroke, or a little more, but we often find times in the service when this is not practicable.

In the matter of detecting [illegible] Beardsley [illegible] of the [illegible] [illegible] erally come from high-pressure packing blowing, caused by the rings being broken. This, however, may be caused by a leaky valve, a loose bushing, cracked bridges, a leaky starting valve, or any defect that will increase the pressure in the low-pressure cylinder, cavity of valve or low-pressure steam-chest. Two light exhausts on one side may be caused by low-pressure packing blowing, which is very hard to detect while running, because the steam is admitted to the low-pressure cylinder at a greatly reduced pressure. The same result may be caused by packing rings in the valve being broken, which will allow part of the steam to escape to the atmosphere while it is passing through or around the valve to the low-pressure cylinder, or by loose bushing, cracked bridges, etc.

One loud exhaust with the Vauclain engine may be caused by either rings No. 1, 2, 3, 6, 7 or 8 being broken. Rings No. 1 or 8 broken gives us more port opening at the end of the high pressure cylinder that ring is broken on, and, of course, more volume of steam in the high-pressure cylinder. This goes to the opposite end of the low-pressure cylinder and gives us one heavy exhaust. If rings No. 3 or No. 6 are broken the volume of steam admitted to the low-pressure cylinder is increased and the effect is practically the same. Rings No. 2 or No. 7 being broken will give one loud exhaust on that side of the engine for the reason that steam will blow by the ring from the live steam-way directly into the hollow of the valve when the steam-port at the opposite end of the valve is open.

If you have one heavy exhaust from the front end on the right side, it may be caused by ring No. 8 in the valve being broken, or perhaps ring No. 2 is broken. In either case the volume of steam, or the pressure, is increased in the low-pressure cylinder and you have one heavy exhaust. This point must be considered when testing for a high-pressure packing blow on the Vauclain engine, as explained later.

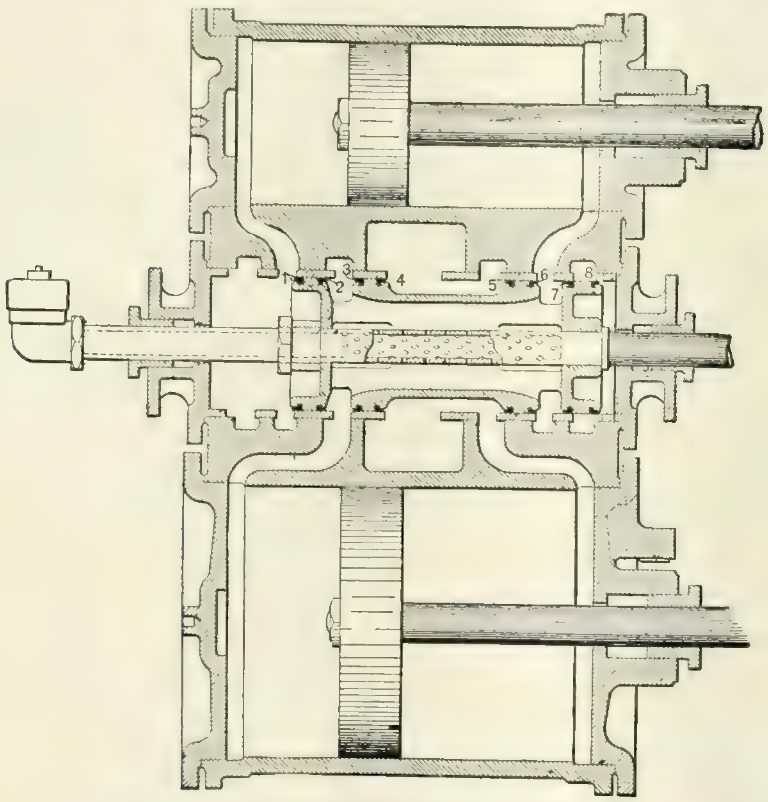
The Tandem compound may have one heavy exhaust from rings No. 5 or No. 8 being broken, which will increase the port opening to the low-pressure cylinder. Rings No. 2 or No. 3 broken in a Tandem merely increases the volume of steam in high-pressure cylinder and low-pressure steam-chest, and gives two loud exhausts. If rings No. 1 and 2 or No. 3 and 4 are broken it increases the pressure in the low-pressure steam chest, and anything that increases the pressure or volume of steam in the high-pressure cylinder or low-pressure steam-chest gives two heavy exhausts on that side of the engine.

If rings No. 5 and 6 or No. 7 and 8 are broken we have two light exhausts, because part of the steam from the low-pressure steam-chest or receiver is blowing by them to the atmosphere. Assuming that we have found which side the blow is on, and that the starting valve is in good order, we should make a standing test to locate the trouble, as follows:

STANDING TEST FOR BLOWS—VAUCLAIN COMPOUND.

Place the engine on the bottom quarter on side to be tested. Block drivers or set brakes and remove both indicator plugs on the high-pressure cylinder. If the engine is not equipped with these plugs, remove pops or water relief valves on the cylinder heads. Give the engine the back motion and make same test. If it is the high-pressure packing that is blowing it will show; while if it is ring No. 7 it will not show.

To test for low-pressure packing, put the reverse lever in forward motion with all the indicator plugs in except the one in back end of low-pressure cylinder. Open the starting valve, which will admit steam to back end of high-pressure cylinder, hollow of valve and front end of low-pressure cylinder. If the low-pressure packing blows you will note it at the back indicator plug. In this same position if rings No. 3 and 4 or No. 5 and 6 are broken, steam will blow through the stack. The blow in either case, however, will be very light, as the



VAUCLAIN COMPOUND CYLINDERS AND VALVE.

steam and in doing this be sure that you open the throttle enough to set the packing rings out against the bushing. These packing rings will leak a little, but if you can cover ports it shows that rings No. 1 and 8 are in good order. In testing for high-pressure packing blow put the reverse lever in forward motion, which opens front port to the high-pressure cylinder. See that the starting valve is closed and indicator plug or pop is out at the back end of the high-pressure cylinder. Give engine steam, and if it blows out of the indicator plug the high-pressure packing may be blowing or ring No. 7 in the valve may be broken.

To determine which this is, replace the indicator plug in back end and remove the front one. Put the reverse lever in steam, you must remember, had to pass through the starting valve.

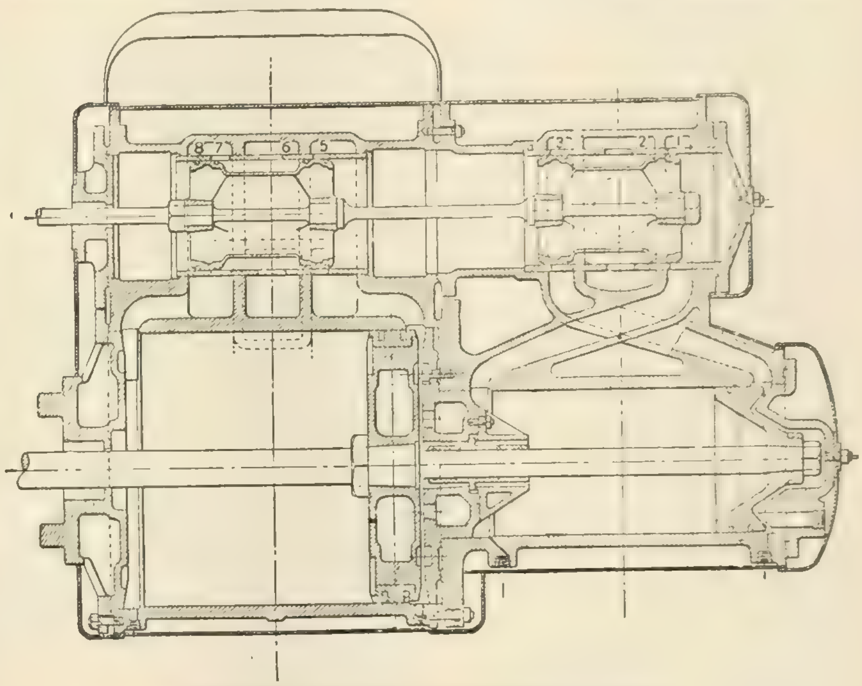
STANDING TEST FOR BLOWS—TANDEM COMPOUND.

Place the engine on the bottom quarter, on side to be tested, block the wheels or set the brake and cover ports. Remove the indicator plugs on high-pressure cylinder. Give the engine steam, using the same precaution to set out the packing rings. If you can cover the ports, it merely shows that rings No. 2 and 3 are tight. To test low-pressure valve, leave the engine in the same position and open the starting valve. Replace indicator plug in high-pressure cylinder and remove those in the low-pressure cylinder, also remove by-pass

valve and screw the cap nut down. If rings No. 5 and 8 are blowing it will blow through the stack and out of the plug. Test high and low-pressure cylinder packing the same as you would with the Vauclain engine. We have one blow, however, on the Tandem that we do not have on the Vauclain engine; this is the sleeve or bushing between the high and low-pressure cylinders, and is tested by admitting steam to back end of high-pressure cylinder with starting valve shut. If this sleeve blows it will show through front cylinder cock or indicator plug in the low-pressure cylinder and blow through the stack. Some authorities advise to place the engine on lower forward eighth in testing for blows. With the compound engine we find the largest part of the cylinder in the extreme end and there is nothing gained by placing the engine on the eighth.

much easier to remove cylinder heads, and I find from experience that it is not necessary to take down main rods. The engineer, being on the ground, should, however, use good judgment in handling his engine, and must be held responsible for its condition. If the engineer is careful in watching the engine work while pulling a train over the road, and makes a standing test on completing the trip, he will generally find what is wrong; but there are so many different blows that have the same effect that we often hear the engineer criticised for not reporting the work right, when he is not at fault. The machinist who does the work should look for loose bushings, etc. This can generally be detected by tapping the bushings over the bridges with a light hammer. He should also look for cracked bridges and cylinders.

In concluding Mr. Beardsley summarized his own observations and those of some locomotive designers, builders and superintendents of motive power in a series of Don'ts.



TANDEM COMPOUND CYLINDERS AND VALVES

In testing for blows we find it very unsatisfactory to go by the cylinder cocks, and for that reason I recommend removing the indicator plugs on the side of cylinders, or the water relief valves on cylinder heads. Some roads are putting indicator plugs in all cylinders. This is, you will find, an improvement, not only as a help in locating blows, but to assist in lubricating when it is necessary to tow the engine in. If for any reason the locomotive is disabled and has to be towed in, there will be no bad effects if you remove all the indicator plugs and the plugs over the valves and lubricate valves and cylinders well. This is quite an advantage, as it would be a hard matter to take down the main rods on the large engines.

In fact, some roads now instruct their enginemen not to take down the main rods in cases of this kind. It would be

"In conclusion," he said, "I wish to add a few 'don'ts.' Don't carry too much water. Don't work too much throttle. Don't fail to keep guides tight. Don't fail to keep guides closed. Don't let engine slip. Don't fail to open the starting valve when you close the throttle. Don't fail to close it shortly after starting. Don't fail to have the reverse lever in full stroke before starting. Don't fail to open cylinder cocks. Don't set out packing rings with the peen of a hammer. Don't fail to examine valves, bushings, cylinders, etc. Don't fail to keep pistons in line when closing guides. Don't jump at conclusions about a blow or the engine going lame. Don't bush the nozzle every time the engine is re-

ported not steaming. Perhaps the engineer or fireman is at fault. Don't blame everything that happens to the compound. The large engine and the compound feature are coming together and if the compound is properly treated it will show a saving in fuel as before stated."

American Correspondence School.

The American School of Correspondence, Chicago, send us some particulars about their educational course, from which we select the following paragraphs:

We invite your attention to the copy of our catalogue which we are sending you under another cover. We believe that it contains much information of interest to you personally on a subject of growing interest to all thoughtful people—Correspondence Instruction.

We want to interest the editors of the representative periodicals more actively in this phase of popular education, a phase in which more progress will in all probability be made in the next five years than along all other lines of educational effort combined. That the people want this form of instruction is shown by the thousands who apply for help to Chautauqua and the various correspondence schools. It is a form of education that has come to stay because it meets a real want, and the position that our representative periodicals take toward this new educational force will do much to hasten or retard its good influence. Many colleges, such as the University of Chicago and Armour Institute of Technology, have adopted it as a regular feature of their work, and others have it under serious consideration.

We should like to call your attention to the following distinctive features of the American School of Correspondence, at Armour Institute of Technology:

The instruction is under the direction of members of the faculty of Armour Institute of Technology, and Dr. Gunsaulus, president of that institute, has given the work his enthusiastic support and personal supervision. Due credit will be given for the work covered by correspondence should the student later pursue his studies at the Institute.

The instruction papers are prepared especially for home study, and are used as text-books by the Government in the School of Submarine Defense at Fort Totten, N. Y., by the Westinghouse Electric & Manufacturing Company, of Pittsburg, which is using over seven hundred of the papers in the "Shop School" maintained for its employees. The paper on "Storage Batteries" is used as a text-book for the Senior Class in Electrical Engineering at Columbia University.

We invite your attention particularly to the list of instructors, text-book writers, and to the Advisory Board. We have students within a few miles of the Arctic Circle—in the Fiji Islands—and in the Falkland Islands, off of Cape Horn. We have over three hundred students in New Zealand alone. Wherever knowledge of American enterprise has penetrated, there will be found correspondence school students.

The catalogue referred to will be sent free to any person expecting to become a student.

Adhesive.

Army and Navy Liquid Glue is the name of the new and very adhesive cement which the Wachter Manufacturing Company, of Baltimore, Md., has placed upon the market. The glue is put up in cans, kegs, barrels and bottles as required, but no matter from what kind of a receptacle it may be taken it stays right where it is put, and by the way, the substances it unites stay there also. It is the glue that glues and it glues anything, and as the manufacturers say, it is "the glue for you." They mean this latter phrase to be taken literally, because at the back of the pamphlet which they have issued telling "what it is, how it is and what it is good for," they say of this pure hide and sinew glue (which is in liquid form and does not need to be prepared in any way), that though they will be glad to have a representative talk the matter over with you, and show you actual tests and proofs of all their claims, yet in the meantime samples and prices are yours for the asking. It is put up conveniently in cans of all sizes, in small mucilage bottles, ready for office use, and in tubes, so that whether you are in shop or office they can give you what you want and you can make things adhere. Write the firm for their little booklet telling the story of its invention or discovery by Mr. J. W. Wachter, late of the U. S. Navy Department, and also ask for a sample and try the liquid glue, or let your wife try it on the cup and saucer you broke not long ago, or you try it in the shop on wood or iron and see for youreslf. You will notice that in offering to give away a sample to those who write for one, the firm is not running a "gum" game, nor are they trying to "stick" you in any way; they simply desire to cement a legitimate business friendship, and the Army and Navy Liquid Glue will do it. Write Wachter Mfg. Co., Baltimore, and say RAILWAY AND LOCOMOTIVE ENGINEERING gave you the clue to the glue.

A number of German, Belgian and Austrian mine owners are using benzine locomotives for hauling cars in the mines. They are a dwarf form of gasoline motor and operated very much in the same way.

The management of the Baltimore & Ohio have undertaken the work of supplying well-equipped buildings at all important division points for the use of locomotive engineers, firemen and other trainmen when they are away from home. The first building will be erected at Glenwood, and will be fitted with smoking and reading rooms on the first and on the second will be tubs, baths and sleeping rooms.

Motor Car Speed Exceeds 114 Miles an Hour.

For several years the electricians connected with Zossen military railway of Germany have been trying to run electric motors at a speed exceeding one hundred miles an hour. Last year and the year before a speed close to 100 miles an hour was attained, but the track displayed signs of collapsing at the high speed and the trials were abandoned. They have now built an extraordinarily strong track with 100-pound rails laid on substantial wooden foundations, and on trials made on it the motor attained a speed over 114 miles an hour, and no weakness of track or motor developed. They expect to attain speed of 125 miles an hour and over. The test is more for scientific than for commercial purposes.

A NEW SINCLAIR COMPANY

Son of Mark Twain's Jack Rabbit.

A jack rabbit that Mark Twain tells a story about has a son which is tormenting the life of a 'Frisco engineer. That engineer has made a request to be allowed to run faster than 85 miles an hour, because a jack rabbit has been making fun of him on his run. A jack rabbit is noted for its speed, and this particular jack, it seems, has been in the habit of [illegible] just south of Olathe, Kansas, when he hears the flyer coming in the morning, looking up and winking at the engineer, and then, throwing back his ears, racing alongside the track. He seems to know that the engineer may not run ahead of his schedule, so he keeps up only a fair speed, but at that he often gets on the track in front of the locomotive, and putting up one foot to his face, spreads out his toes and makes a sign perfectly familiar to all small boys, which is expressive of the highest scorn and derision. This is a true story and vouched for by a Kansas paper.

The coal handling machinery installed by the C. W. Hunt Company, West New Brighton, N. Y., at the Lincoln Wharf Power Station of the Boston Elevated Railroad Company recently lowered the world's record for rapid unloading. The coal was raised 90 feet above tide water and delivered to the storage pockets at the rate of 320 tons per hour. The installation follows in general design the standard Hunt steeple tower rig, the moving gear and coal cracker being electrically driven, and the hoisting engine direct connected. The overhang of the folding boom is 40 feet, and the capacity of the shovel two tons.

The New York offices of the sales organization of the Westinghouse Electric & Manufacturing Company, consisting of the New York sales department, the export department and the general agent's office, have been removed to the new Hanover Bank Building, corner of Nassau and Pine streets. The new offices occupy the entire seventeenth floor of this building, where the arrangements and facilities will be of the best, both for the representatives of the company and the public with whom they do business. The mail address of the several departments of the Sales Organization in New York will be No. 11 Pine street. The telephone number, 6131 Cortlandt, remains unchanged. The executive, financial and stock transfer offices will remain on the fourth floor of the Equitable Building.

Extraordinary ratings were made by the candidates for the scholarships which Jos. T. Ryerson & Son gave to the Master Mechanics' Association. Seventeen candidates were examined, and the highest grade (91 2-3) was obtained by Mr. A. B. Marsh, of Boston, who was examined under the supervision of the authorities of the Massachusetts Institute of Technology. The second is Mr. A. A. Kellogg, with a grade of 91 1-3. The third is Mr. H. L. Richardson, with a grade of 91 1-6. It is a great pity that more scholarships of this character are not available.

She Had the Right to the Seat.

A man who had been dining walked into a Christopher Street Ferry boat one night last month and took the only vacant seat in sight. Seeing an acquaintance on the opposite side he walked over to say how are you, old friend, leaving his hat to keep his seat. Just as he began to pay his respects to the acquaintance he noticed a big negro woman approaching his seat.

"That's my seat," he exclaimed, but the woman had plumped down before he could stop her.

"No suh," she replied, "dis is de side for ladies, an' drunken loafers am not allowed here."

"You get up," he shouted, "there's something under you."

"Yes," she replied, "the seat is under me, and it will be dar till I get to Hoboken."

When she arose the man's plug hat looked like a concertina and he had to fit it upon his leg before it would go on his head.

Smith's Exhaust Arrangement.

Several very ingenious locomotive exhaust pipes were invented by Mr. John Y. Smith, the inventor of the vacuum brake. Mr. Smith had made a great study of induced currents and was remarkably well informed about locomotive draft appliances. His last arrangement was put upon an engine belonging to the Pittsburgh & Lake Erie Railroad several years ago. Wondering what had been the fate of the invention, we recently wrote to Mr. J. H. Turner, superintendent of motive power of the railroad mentioned, and we have the following letter about the invention:

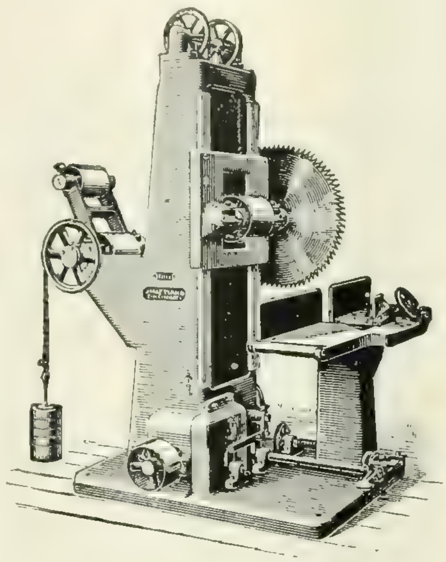
It is true that we experimented with the above mentioned device on three different classes of engines in order to demonstrate beyond all question as to its merits. Not knowing as to whether or not you are familiar with the device, will say that it was composed of an exhaust pipe, surmounted with a perforated cap. When first placed in service, the area of the perforations was sufficient to relieve the engine, but each day the holes became a little smaller, due to the oil from the cylinders mixing with the smoke from the fire box, which resulted in increased compression, stopping up of boiler tubes and various other ills, which rendered the device entirely impracticable. The same device was tried on a number of other roads, but has never been adopted anywhere.

The Nernst Lamp Company, of Pittsburg, has recently established an agency for the sale of Nernst lamps and supplies with the W. G. Nagel Company, Toledo, Ohio, this company having for several years acted as selling agents for the Westinghouse Electric & Mfg. Co.

New Cut-Off Saw and Gainer.

This cut represents a new and improved machine especially built for car shops. Special attention is invited to some of its features. It will carry a saw 40 inches in diameter, cut-off material 13 inches square, or 26 inches wide by one inch thick, and when proper gaining head is used, will cut a gain 6 inches wide and 1½ inches deep. The head expands from 3 to 6 inches. The column is securely bolted and has a large base, decreasing vibration.

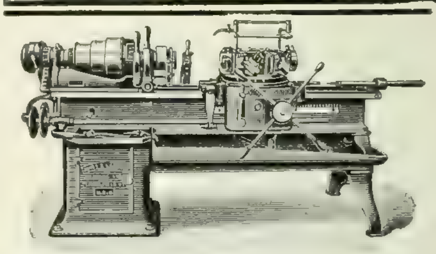
The feed raising the arbor consists of frictions operating on two large screws resting on ball bearings, nuts being fitted to take up all wear. The arbor is easily adjusted, controlled by treadle convenient to operator, and the travel regulated by adjustable stops. The table is mounted on a stand, adjustable to and from the arbor, and can be swung to an angle of 30 degrees. It has friction rolls on each side, and provision is made for securely holding the work. The machine can be belted either overhead or from below, the swinging idler being reversible to bring the weight into action for either position.



CUT-OFF SAW AND GAINER.

Further particulars, cuts fully describing it and terms, will be willingly sent by the makers, J. A. Fay & Egan Co., of No. 445 West Front street, Cincinnati, Ohio, who will also send free their new catalogue showing their machines, to those interested who will write, mentioning this paper.

Some engines on the Burlington & Missouri River Railroad in Nebraska have recently been equipped with the Edwards electric headlight. Some of these engines run in the open stock country and the light has been found very advantageous by engineers from the fact that its powerful illumination of the track ahead enables them readily to see stock on the



track. The animals often seek the open line of the right of way in order to be free from the annoyance of flies, etc., and for coolness in the summer nights. Even if the animal found on the track by this "railroad searchlight" be too small to be deemed dangerous to the train, the fact that it can be seen in time and in every instance driven off, has a very decided tendency to reduce chances of claim against the company, together with the likelihood of troublesome litigation to follow

---

The City Council of Richmond Ind a small one-horse hamlet, at its last meeting took action on two or three things of more than ordinary interest. It was decided to make the effort to stop the whistling done by locomotives while within the city limits, and the police were notified to serve notice on the railroad companies that the practice must stop

---

The roller bearings for cars is getting another trial. The first invention of that character was patented by Ross Winans, about 1830. It was as good as any of its numerous progeny. The latest roller bearing car was exhibited at Detroit last month and met with much favor among the operating officials who attended the national convention there. It is claimed that just half the power will carry this car that is required for the car with the ordinary bearing, claimed, of course.

Americans and Europeans have been for years mystified about the value placed by Chinamen on the roots of a plant called ginseng. It appeared to have no medicinal property and chemists long declared that its constituents were nothing better than those of common weeds; but an analytical chemist who has lately been making very exhaustive tests of ginseng roots declares that they contain an element new to chemistry. Meanwhile the market value of the root is on the rise.

The Master Steam Boiler Makers' Association will hold its second annual convention in the Palmer House, Chicago, October 7, 8, 9 and 10, at which time it is expected that the largest number of superintendents, foremen, assistants and layers-out of boiler shops ever congregated together will be present.

It is announced on apparently reliable authority that the Pennsylvania Railroad contemplates the erection of two additional steel car plants at Altoona, after the completion of the one now being built. They will cost together, $1,000,000. Changes and improvements in the present style of cars will likely be made.

Railway and Locomotive Engineering

Copyright by Angus Sinclair Co. 1903

A Practical Journal of Railway Motive Power and Rolling Stock

Vol. XVI. 174 Broadway, New York, November, 1903 No. 11

THE CROMER EXPRESS—GREAT EASTERN RAILWAY. THIS IS THE SHOW TRAIN ON THE "POOR MAN'S LINE"—131 MILE RUN IN 2 HOURS 38 MINUTES. AVERAGE SPEED, 49.7 MILES PER HOUR WITH HEAVY TRAIN. PHOTOGRAPH TAKEN WHEN ASCENDING BRENTWOOD BANK, A GRADE OF 1 IN 100.

The Age of Specialists.

He used to be the mechanical oracle of every community, great and small. He could patch up a machine that the machinist swore wasn't worth the rivets required in the patch. He could make a condemned boiler carry more steam than ever without a simmer. He could repair a watch, grind skates, put rivets into bladeless knives, make humming tops and botch up good work with a caution. He was attached to the machine shop and roundhouse about the same as a liveried fool was to the court of foolish kings. His work is over and his days numbered. This is not the stone age, or the iron age, or the age of steel, nor yet the age of progress—it is the age of specialties. A few years ago and a printer must be a writer, proofreader, pressman and compositor, and know all the details of the business from blank paper to the gilt-edged book—even to living on store orders. A machinist must be everything, from a watchmaker to a foundryman. A locomotive engineer must know how to build his engine, repair it, clean it, wash boiler, teach firemen, know the rules of the road and laws of the State concerning the same—and we had mighty poor engineers until locomotive engine running was recognized as an exclusive mechanical specialty, and men trained for that specialty. A few years ago, if a breakdown occurred in the shop all hands sat down and waited for the Jack-of-all-trades to come to the rescue. Now they have men specially trained to look out for the breakdowns. In all well-managed shops they have a man who has charge of the belting, and if a belt needs lacing he does it in his own room—for he keeps a duplicate of every belt in the place in reserve. If the main belt breaks there is not a hundred men idle while half a dozen repair the belt, the "extra" takes its place and the other is repaired and itself goes on relief duty.

The writer was in a railroad repair shop recently when the division superintendent brought in a typewriter to be fixed—said it was out of kilter. The foreman looked at it, struck a key or two, and remarked: "I don't know much about these things."

"Why," exclaimed the superintendent, "you have the reputation of being the best mechanic on the road; I thought you were just the man." The foreman turned to the speaker and said: "I am a locomotive repair machinist, and have carefully studied it for fifteen years; if you will bring me any job on a locomotive that I cannot do that any other mechanic can, I will resign; life is too short for a man to spread himself out so thin as to attempt to be familiar with all classes of machinery. There are men who make a specialty of typewriters, as I do of locomotives. They can repair that machine in half the time, for half the money, and twice as well as I can. I would be as foolish to attempt to put new letters on that machine as the maker of typewriters would be to put a new tire on a locomotive."

Let every mechanic have a specialty and stick to it.

Locomotive Life.

Statistics have been completed recently which state that the average life of an English express locomotive is twenty-five years, of a local passenger engine twenty-five years, of a freight locomotive twenty-six years and of a switch engine twenty-seven years. The total mileage of an express passenger engine was fixed at from seven hundred thousand to one million miles, and for each of the other classes of engines a mileage of five hundred thousand to eight hundred thousand.

In the United States the average life of an express locomotive is eighteen years, of a local passenger engine nineteen years, of a freight engine sixteen years and of a switch engine twenty-two years. Whereas the mileage of an English express locomotive was only at the outside 1,000,000 miles in twenty-five years, or forty thousand a year, in the United States it is often as high as 2,000,000 miles, or 110,000 miles a year.

The Right of Passage.

Mr. H. H. Vreeland, president of the Interurban Street Railway Company, in a paper recently read before the American Street Railway Association, put forth a plea for the superior right of passage of a street car along the street. He showed that the street railways of the country serve a larger number of persons than does any other public electrically operated utility. The average number of times each person in this country uses the telegraph is twice in the year, and he uses a telephone on the average between forty to fifty times a year, but the average man will ride about sixty-three times on a street car in the same time. Putting it in another way, Mr. Vreeland said that where the individual spends one dollar on electric light from central stations he spends $3.20 for transportation in electrically propelled street cars.

In the face of these facts any request of the companies for additional terminal facilities or higher speeds are usually regarded as attempts to better themselves at the expense of the city and the rights of the man in the car are overlooked. On the principle of the "greatest good for the greatest number," common sense would seem to dictate that a crowded street car from the preponderance of the number of persons it contains should have a superior right of passage to a vehicle with only one or two persons in it, or to a van or dray containing merchandise. Mr. Vreeland's logic in this matter is irrefutable. It is for just such a reason that fast passenger trains on a steam railroad are given right of way over mixed and freight trains, and nobody regards the operation of that rule as a hardship.

New York Railroad Club Meeting.

The first meeting for this season of the New York Railroad Club was held at Carnegie Hall, New York, on 18th of September, Mr. H. H. Vreeland, president, was in the chair. There were two papers presented. The first was by Mr. Lawford H. Fry, of the Baldwin Locomotive Works, on the Proportions of Modern Locomotive. The paper was the result of a great deal of special work and was in substance the collection and arranging of data concerning a group of each type of locomotive recently built. The paper will be a valuable one for reference.

The second paper was read by Mr. Ira C. Hubbell, of St. Louis. His subject was the Effect of Cylinder Clearance upon the Quantity of Steam consumed in doing Specific Work, with special reference to Locomotive Practice. He said that in ordinary locomotive practice the clearance generally amounts to about 8 per cent. of the cubic contents of the cylinder or what is called the piston displacement, but with a valve movement so timed and arranged as to not only delay opening and closing of the exhaust ports at the early parts of cut off, but at all points of cut off so that these events do not occur until the piston is within about 3 ins. from the end of its travel, regardless of the point of cut off, the cylinder clearance, by which was meant the space in the ports and the striking distance of the piston, may and should be reduced to 2½ per cent. or less in a 20x26 in. cylinder. The discussion which followed was animated, and several interesting points were brought out.

Duty on earth, restitution on earth, action on earth; these are the first steps upward.—*Little Dorrit.*

Men Who Helped New Jersey.

"New Jersey," says William B. Wilson, in his History of the Pennsylvania Railroad, "is deeply indebted to the early promotion of its internal improvements for its great prosperity and rapid growth. They were more than ordinary men. Prominent among them were John Stevens, engineer, architect, patriot; Robert L. and Edwin A. Stevens, naval constructors, inventors in steam appliances, railroad material, armored ships, bombs, organizers, constructors and managers of railroads; John S. Darcy, eminent as a physician and publicist, generous, genial and infatigable; John P. Jackson, lawyer, statesman, giving up public life to serve his State in promoting and managing the New Jersey Railroad, energetic, efficient, faithful and liberal, religious and charitable, and Robert Field Stockton, who wrote his name on the waters of the globe, the great commodore, the conqueror of California, statesman, patriot. These were the leading men that brought prosperity to the State through the mediumship of lines of transportation conducted on business and equitable principles."

Old Fashioned Rate Cutting.

We have been under the impression that ruinous public rate cutting was a thing of the past among railroad companies, but the *Monthly Review*, published by the National Civic Federation tells a different tale. We quote from a recent issue of that publication the following item:

"Houston, Tex., Aug. 17.—Five hundred tickets were sold to Chicago yesterday at startling prices as the result of a war of ticket brokers, the outgrowth of the fight of the Missouri, Kansas & Texas, the International & Great Northern, the Cotton Belt and the Santa Fe for Northern passenger business.

"The lowest rate before yesterday was $18 for the round trip. One broker cut it to $8. Another broker at once cut it to $4. Yet another announced Houston to Chicago, 30 cents; Houston to St. Louis, 20 cents; Houston to Kansas City, 10 cents.

"Another met the cut and offered a $5 box of cigars with each ticket."

When Oliver Evans applied to the Legislature of Maryland for a patent or protection for the invention of a road wagon to be propelled by steam the application was vigorously opposed by Benjamin H. Latrobe, who denounced the inventor as a visionary. Latrobe produced figures which seemed to prove that all the power which the engine could produce would be used up in moving the wagon. Light seemed to come to that family later, for Latrobe's son became a famous civil engineer and was chief engineer of the Baltimore & Ohio Railroad.

Growth of the Locomotive.

BY ANGUS SINCLAIR

(Continued from page 417.)

THE SELLERS LOCOMOTIVES.

Those familiar with the history of early locomotives in the United States are aware that the Philadelphia & Columbia Railroad had two locomotives built by Coleman Sellers & Sons, but very little is popularly known about the engines, although they possessed features of design which ought to have made them famous.

Coleman Sellers was the descendant of a family that had come from Derbyshire, England, with a party brought out by William Penn. They were a race of skilful mechanics.

COLEMAN SELLERS & SONS.

Coleman Sellers had four sons, of whom the two elder, Charles and George Escol, with him constituted the firm. In 1834 the senior died and the brothers continued to carry on the business at Cardington, close to Philadelphia. In a series of engineering reminiscences contributed by George Escol Sellers to the *American Machinist* in 1885 he gives the following particulars about the building of their locomotives.

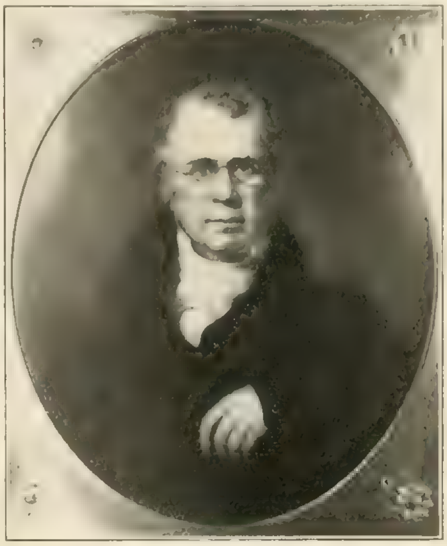
BIG PIONEER MACHINE TOOLS.

"In the year 1834 the foundry and machine shop then carried on by my brother

CHARLES SELLERS.

and myself were mostly engaged on work for iron furnaces, rolling mills, flour mills and machinery for paper making. To turn the drying cylinders for the latter we constructed what at that time was considered a mammoth engine lathe that would turn 9 ft. in length and 4 ft. 10 ins. diameter. Also for finishing the housings for paper-press rolls and calenders, we had built and put in operation the first iron planing machine in the State of Pennsylvania. If I recollect right there were only two others in the United States, one at West Point, N. Y., shops and the other at Dr. Nott's Novelty Works. This primitive machine had a capacity for 8 ft. length by 4 ft. wide and 3 ft. high. . . .

"In the latter part of the summer of



COLEMAN SELLERS.

1834 James Cameron, brother of the Hon. Simon Cameron, at that time chairman of the Board of Canal Commissioners, called on us and said that he had been informed by John Brandt that we had the above described lathe and planer, both well adapted for locomotive work and asked if we would undertake the building of some locomotives for the State railroad. As the paper machinery and other work was slack, we took the subject under consideration and a few days later I accompanied Mr. Cameron to the Parkesburg shops to see and consult with their engineer and with Mr. Brandt, foreman of the shops. . . .

UNDERTAKE TO BUILD LOCOMOTIVES.

"The result of the trip was that we undertook to build some engines for the State road, the commissioners stipulating that the boilers should be dome boilers, one pair of drivers back of the fire box and cylinders outside of the smoke box, drawings to be made and submitted to their approval. Brandt was very pressing that we should undertake to build these engines. He proposed while making the drawings to give me the advantage of what experience he had with the English locomotives with the Baldwin engine and with one of Norris' that was having some changes made on it.

"Before commencing the drawings I had several discussions with Brandt and while making them he several times came down to the city and remained over night with me. It soon became evident that requiring the driving wheels to be placed back of the fire box was more due to Mr. Brandt's opposition to full cranks in front of the fire box with the cylinders, valves and their connections under the smoke box, than that urged by the commissioners of unequal distribution of weight and its injurious effect on the rails.

[illegible] FULL CRANKS.

"It was also evident that full cranks could not be placed back of the fire box and the cylinders outside of the smoke box without reducing the diameter of the boiler and narrowing the fire box to an extent that was not admissible.

"I proposed outside connections, but that would not be listened to. The Baldwin half crank must be adopted, but this we refused without written consent from Mr. Baldwin, which Mr. Cameron undertook to secure, saying he would pay a reasonable consideration for its use. Mr. Cameron returned saying that Mr. Baldwin had applied for a patent on the half crank; that he had made the invention for his own protection and it was not for sale on any terms.

OUTSIDE CYLINDERS PROPOSED.

"In this dilemma I again unsuccessfully urged outside connections. I proposed to equalize the weight by another pair of drivers back of the fire box (afterward done by Campbell) connected by outside

GEORGE ESCOL SELLERS.

cranks in the manner of the English four-wheel engines, the front pair of drivers having full crank axle. I made a sketch of this which met with Mr. Cameron's approval, but Mr. Brandt would not give way in his objection to the cylinders with steam connections under the smoke box, he had so much trouble with English engines. He finally joined me in advocating outside connections. Mr. Cameron said the commissioners were not willing to risk experiments. I urged that outside con-

nections was no experiment, that Stephenson's Rocket, Hackworth's Sanspareil, in fact, most of the early English locomotives were outside connected. . . .

"We offered to build either as I had suggested with full cranks and two pairs of drivers or outside connections and one pair of drivers back of the fire box, but it was not until we guaranteed against injurious oscillation that the latter plan was accepted. . . .

"I made the drawings and submitted them thinking everything would be satisfactory, but I was mistaken. My drawings called for iron frames instead of wood, that up to that time was the only frame in use. It was objected to on the ground of its having too much rigidity. After considerable argument and delay the iron frame was approved of."

ORIGINALITY IN DESIGN OF THE ENGINES.

After a great many trifling objections had been raised and overcome the engines were eventually built. They had outside cylinders with a single pair of drivers behind the fire box and a four-wheel truck with a center bearing. The frames were iron and the driving wheels had counterbalance weights bolted opposite the crank. Mr. Rogers, of Paterson, visited the shop when the engines were under construction and expressed approval of the counterbalance weights, but thought they ought to have been cast in the wheel center.

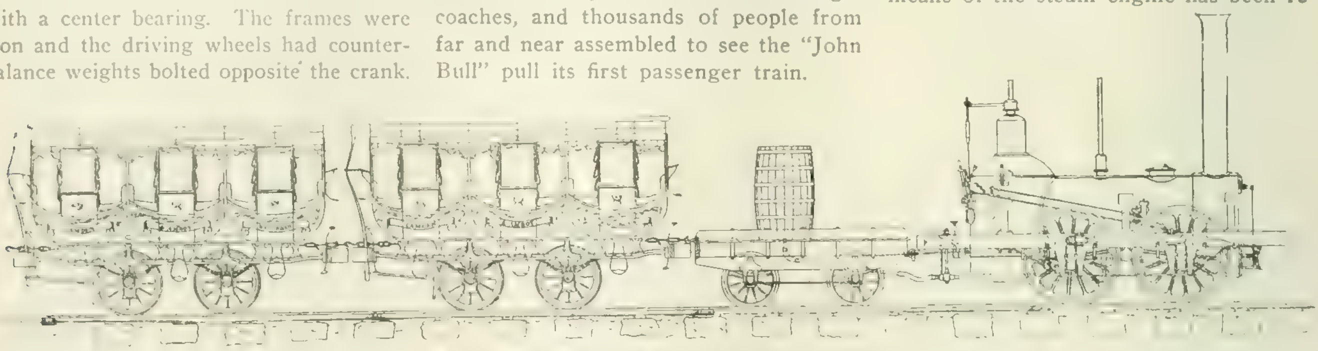
The engines gave much satisfaction in service, and the four novelties of design, the outside cylinders, the iron frames, the counterbalanced driving wheels and the center bearing truck, were all gradually adopted by American locomotive builders, but I am not aware of the credit of these improvements ever having been given to those who originated them. They possessed all the elements of what afterwards became the representative "American locomotive" except the second pair of drivers, and that arrangement the builders had proposed.

The Pennsylvania Railroad Company was a direct development of the Philadelphia & Columbia Railroad, but it afterwards absorbed a line which was earlier in operation and one of the first railroads in the United States to begin operating. This was the Camden & Amboy Railroad.

THE CAMDEN & AMBOY RAILROAD

The Camden & Amboy Railroad and Transportation Company was incorporated by special charter in February, 1830; and the company was authorized to survey, lay out and construct a railroad from the Delaware River to Raritan Bay, with as many tracks as might be deemed necessary, provided the width of roadway did not exceed 100 feet. A lateral road from the main line to Bordentown was also authorized. The road was to be commenced within two years and completed within nine years, otherwise the charter would be null and void.

Considerable opposition to this railroad was made at first by the canal interests; but they finally formed a combination and the construction of the railroad proceeded without interruption. A portion of the road near Bordentown was opened late in 1831 with becoming ceremonies, this having been the first railroad opened in New Jersey. Among the guests of the railroad company on this occasion, was Madame Murat, wife of Prince Murat, a nephew of the first Napoleon. The members of the legislature came in a body from Trenton in stagecoaches, and thousands of people from far and near assembled to see the "John Bull" pull its first passenger train.



THE "JOHN BULL" AND ITS FIRST TRAIN.

NEW JERSEY HAD FIRST RAILROAD CHARTER EVER GRANTED.

The Camden & Amboy Railroad was not the first project of the kind agitated in New Jersey. As early as 1815, the legislature of that State passed an act creating a company "to erect a railroad from the Delaware River near Trenton to the river Raritan near New Brunswick." Commissioners were appointed to raise money by subscription to execute the work; but the enterprise died for want of financial support. Its promoters were ten years in advance of the railroad building sentiment.

The movement is of historical interest because it was the first company in the world formed to build a railroad for general transportation purposes.

QUAKER AND ARISTOCRATIC BORDENTOWN.

The old town of Bordentown, 28 miles from Philadelphia, was well worthy of being the starting point for the first railroad train to run in New Jersey. Situated on a bend of the Delaware River which formed the nearest point to water communication with New York, the people of the place had long been noted for their enterprise, in maintaining stage coach lines to South Amboy, the shipping point for New York. The railroad, which the people of Bordentown did much to promote, was eventually the ruin of the town, for it was left a way station on a branch line. It was originally a quaker settlement, yet one of the most cherished glories of the place was that it was for years the residence of Joseph Bonaparte, brother of Napoleon.

CAMDEN & AMBOY'S CELEBRATED PIONEERS.

The Camden & Amboy Railroad Company exercised a powerful influence on the development of the locomotive engine; but the work was due principally to the ability of two men, Robert L. Stevens and Isaac Dripps. Mr. Stevens was president of the company and Mr. Dripps was a young machinist and marine engineer whom Mr. Stevens engaged to take charge of the machinery of the railroad.

Robert L. Stevens was a son of John Stevens, whose wonderful foresight into the future of land transportation by means of the steam engine has been repeatedly referred to. The son was as progressive and enterprising as the father, and was besides an engineering genius. He effected celebrated improvements on steamships, invented along with his nephew the famous Stevens cut-off, first applied anthracite as fuel to steamers, invented the T-rail for railroads, and did many other wonderful things.

About the time that Robert L. Stevens became president of the Camden & Amboy Railroad, he found Isaac Dripps, while still an apprentice machinist, in charge of the erection of the machinery of one of the largest steamboats that had ever been built, and doing other important marine engineering work. Mr. Stevens recognized in the young engineer the material from which leaders of men and managers of great enterprises are made, and engaged him as master mechanic of the Camden & Amboy Railroad.

ERECTION OF THE JOHN BULL.

The first work which Mr. Dripps did was to put the locomotive, which was originally called the Stevens and which they had christened the "John Bull," into working order. The engine had been ordered from Robert Stephenson & Co.

and was received at Philadelphia in 1831. Mr. Dripps transported it in a sloop up the Delaware River to Bordentown, where he put the parts together. He had never seen a locomotive engine before, but he studied the mechanism carefully and succeeded in erecting it without making a mistake.

OVERCOMING DIFFICULTIES.

The engine was not provided with a tender, but this did not embarrass Mr. Dripps much. He found a small four-wheel car that could carry enough wood to last a short trip, and for water tank he purchased a whisky cask from a neighboring grocery. For a hose to connect the tank and engine feed pipe, he called in the services of a shoemaker, who made a leather pipe that answered the purpose. Thus equipped the engine was ready for the service of hauling the spectacle passenger train.

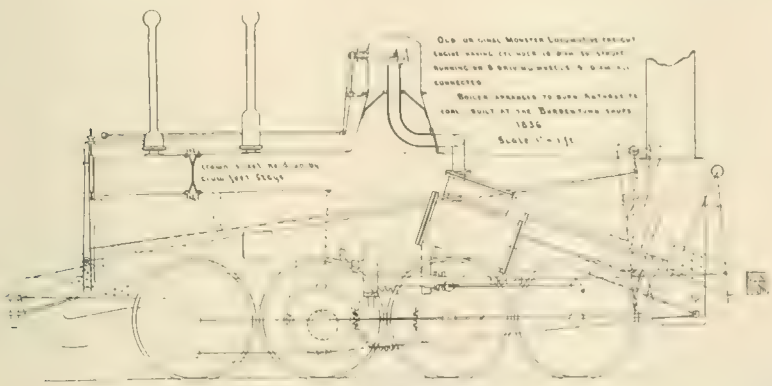
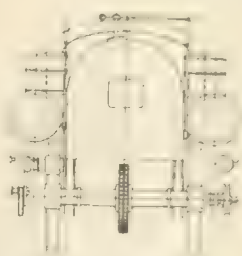
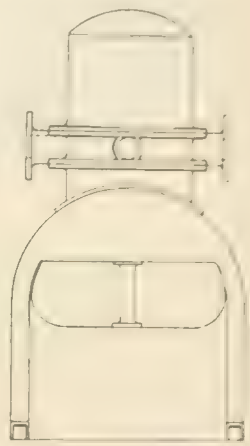


FIG. 39.—ORIGINAL MONSTER.



SECTION THROUGH REAR AXLE.



SECTION THROUGH FIRE BOX.

The company had ordered several new engines from England, but Mr. Stevens did not propose to be dependent on foreign makers for the motive power of the railroad. He opened shops in Hoboken for the construction of locomotives, and Mr. Dripps had general charge of the work.

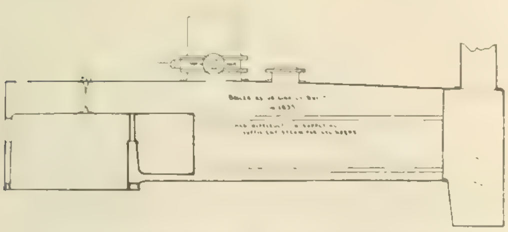


FIG. 40.—ORIGINAL BOILER OF MONSTER.

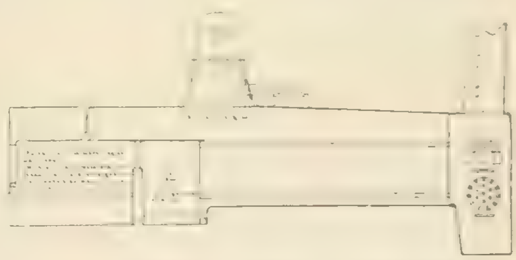


FIG. 41.—REBUILT BOILER OF MONSTER

THE COW CATCHER.

In the first few locomotives he built Mr. Dripps imitated the John Bull in wheel arrangement and in running gear, but the boilers were made without the hemispherical dome. The necessity for a pilot to push obstructions off the track early became apparent, and Mr. Dripps designed and applied to the engines the two-wheel pilot or cow catcher, now on the John Bull, as shown in our August number. This was made to carry some weight off the front driving wheels, and performed in an inferior way the functions of the Jervis swiveling truck.

Cow catchers were peculiar to American railways, and were made necessary through the unprotected condition of the track, which was rarely fenced. In other countries the owners of domestic animals were held responsible for keeping them off the property of a railway company, just as they were held responsible for the trespass of their animals upon any other property; but a different policy was inaugurated with railroad construction in the United States. It became the recognized practice to hold the railroad's responsible for any damage done by trespass of animals upon their right of way, and the cow catcher was introduced to prevent the neighbors horse, or his ox, or his ass, or his hog, from throwing trains off the track.

The first cow catcher was a heavy cross-bar secured in front of the leading pair of wheels. A master mechanic in Philadelphia & Reading used double bars and fortified them with long spikes like elongated harrow teeth. A stray bull was impaled on this weapon shortly after it was introduced, and the use of a switching rope was necessary to detach the animal. That form of bull catcher was at once ruled out of use, and the germ of the modern pilot soon appeared. The sleigh-like contrivance put on the "John Bull" did not attain any popularity.

The first three locomotives built by Mr. Dripps at Hoboken were taken by him to South Amboy, where they were used to haul material and to perform the part of schools to instruct men in the art of locomotive engine running. The school of experience was the principal institute of instruction afterwards, but in 1832 a special school was necessary.

NEW JERSEY AS A BARRIER BETWEEN POPULOUS REGIONS.

Before railroads were opened the State of New Jersey seemed to act as a barrier between the two great centers of population, New York with its drainage of business from the whole of New England and Philadelphia, which was the entrepôt of commerce from a vast region to the South and West.

Although the distance between New York and Philadelphia is only about ninety miles, the journey was a remarkably tedious one in the beginning of last century. The most expeditious journey was to take a boat from New York to South Amboy, then a thirty-five mile stage ride to Bordentown, thence 28 miles by the Delaware River to Philadelphia. The trip which is now done in two hours was generally performed in two days and that was considered wonderfully fast traveling.

The opening of the Camden & Amboy Railroad greatly stimulated the traffic between New York and Philadelphia, and the railroad company had more than enough to do in trying to provide power and rolling stock to move the growing business. The railroad had not been in operation more than two years, when

ROBERT L. STEVENS.

President Stevens and Superintendent of Machinery Dripps began consulting about the desirability of building more powerful locomotives than anything that had previously been thought of.

THE MONSTER.

The result of consultations was the designing of a class of locomotives known as the "Monsters." The first of these engines was partly built in Hoboken—the boiler in New York and the parts were assembled in the company's shops at Bordentown in 1836. The original design of the engine copied from shop drawings is illustrated in Fig. 39.

In 1885 Isaac Dripps sent some tracings of drawings to the American Railway Master Mechanics' Association; and in a letter concerning them he says: "Plate No. 1 (Fig. 40) shows a boiler for burning anthracite coal for 18x30 inch cylinder freight engine, built in New York in 1835 for the Camden & Amboy Railroad Company. The furnace of this boiler, at its front end and some distance back from the tube sheet, had a bridge wall, or water space extending upwards to within 13 inches of the crown sheet. Between the bridge wall and tube sheet was a combustion chamber.

"The boiler as originally constructed was very deficient in steam making, and after being in use some time she blew off the dome, breaking through the cast iron throttle valve at the bottom of the dome.

CONVERTING A COMBUSTION CHAMBER INTO A FIRE BOX.

"In rebuilding the boiler, I altered the combustion chamber into a small fire box, by cutting away the bottom of the boiler between the tube sheet and the bridge wall, placing the grate bars low down and putting a fire door on the side. The bridge wall, or water space, being so high, that is near the crown sheet, gave me sufficient room to raise the grate bars of the main or back fire box.

"These alterations of the boiler with the use of the exhaust jet box inside of smoke box, and tapered smoke pipe, increased the steaming qualities of the boiler very satisfactorily. This was the first time that the exhaust jet box was ever used." (Changes shown in Fig. 41.)

In the bridge that separates the furnace from the combustion chamber is a flanged pipe extending through the crown sheet for the purpose of promoting circulation. The crown sheets of fire box and combustion chamber were supported by crow-foot stays, which were found to be perfectly satisfactory.

FIG. 42.—THE REBUILT MONSTER.

DESIGN OF ENGINE.

The engine part of the Monster was very peculiar, the design having no doubt been influenced by Mr. Stevens' and Mr. Dripps' connection with marine engines, which in those days included many curiosities. It was an eight-wheel connected engine, each set of four wheels being free to move in a plane slightly different from the other set, which gave it some flexibility in passing curves, the idea of which was afterwards developed by Fairlie, Mason, Mallet and others.

The cylinders, which were 18x30 inches, were set on the side of the boiler at an angle of about 30 degrees, with the piston working towards the front. The cross-head connected with a vibrating beam which the men called the "horse neck," that moved like a pendulum. A main rod was connected to the pendulum and transmitted power to the third pair of wheels, which were the driving wheels. Between the second and third pair of wheels was a supplementary shaft carrying a gear wheel, which engaged with gears on the second and third axles by that means transmitting the power to the forward wheels. Each set of four wheels was provided with connecting rods the crank pins on the forward set being located on the opposite side of the wheel from the hind set.

The valve motion was driven from a return crank on the main pin, as shown in the rear section. It will be noticed that this return crank carried an eccentric as well as a pin. The eccentric moved one of the drop hooks, the pin the other, being the first time this arrangement was used. There was a riding cut-off valve like other cut-off arrangements common in those days, and it was driven by connection with the pendulum lever.

Large copper exhaust pipes were used, and each had a feed pipe traversing the inside for the purpose of heating the water.

There was no frame used, all the attachments having been secured to the boiler. The axle box pedestals were riveted to the boiler. The four back driving boxes had wedges, but the forward boxes had none, the loose fitting box in the pedestal being designed to give some flexibility in rounding curves.

The engraving, Fig. 42, shows the Monster rebuilt into a ten-wheeler and numbered 635 of the Pennsylvania Railroad's list. The engraving was made from an old tintype found by Mr. John A. Hill in 1890 when he was editor of the *Locomotive Engineer*. Some details of the picture were very obscure, but people who were acquainted with

ISAAC DRIPPS.

the engine say that the likeness is faithfully brought out. The engine was in use as late as 1875.

The Monster was not a success as a locomotive, but its work was sufficiently satisfactory to bring an order for three others, which were built at the Trenton Locomotive Works.

(To be continued.)

Railways of the Ancients.

Railways, composed entirely of massive blocks of smooth stone and adapted to the passage of wheeled carriages, are still in existence in the vicinity of the quarries whence the stupendous stones were extracted which were used in the construction of the Pyramids. These roads have been incidentally mentioned by the French and Italian savants who have visited that cradle of the arts; but none of them have hitherto imagined that they were, in fact, railways. Their preservation for three thousand years, notwithstanding their exposure to the assaults of time, the havoc of war and the ravages of barbarians, is remarkable, while every vestige of the numerous canals which were constructed by the Ptolemies, or the Caliphs in Egypt, has long since been obliterated from the face of the earth. In Palmyra and Balbec, similar railways still exist; and in Cyrene, in Africa, long lines of such railways, composed of stone blocks, may yet be traced for many leagues, connecting the ruins of the once splendid cities which the modern desert contains.

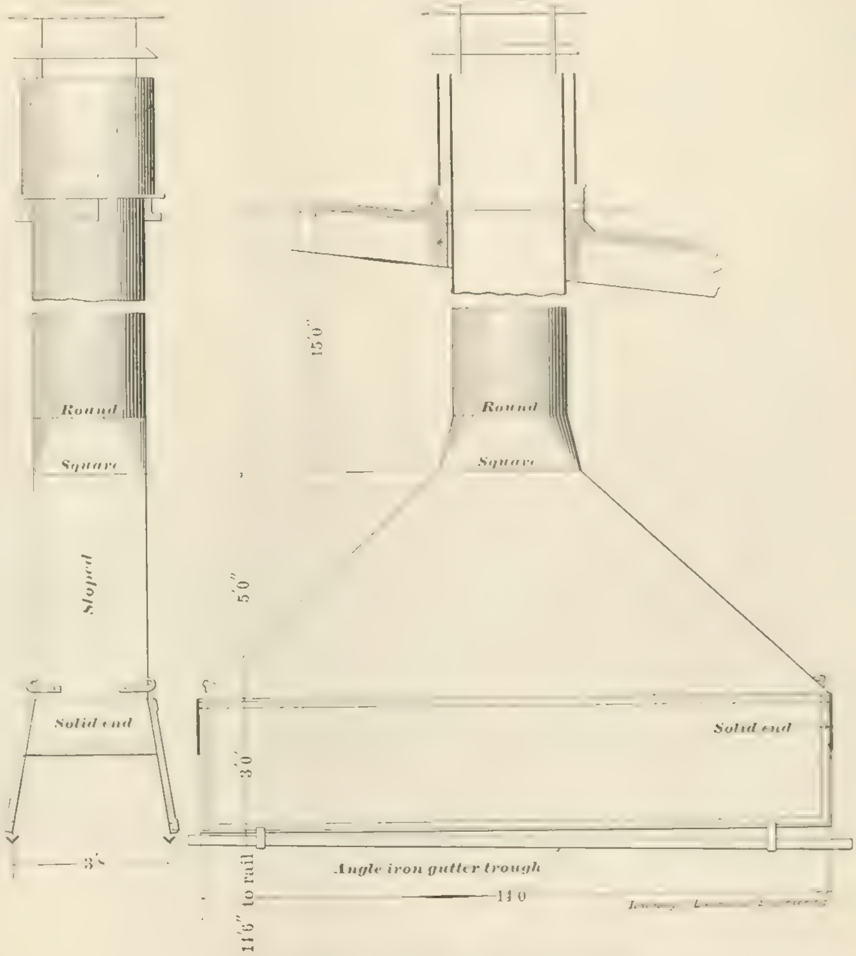
Efficient Smoke Jack in P. & L. E. Round Houses.

A very satisfactory smoke jack is in use in the MeKees Rocks Roundhouse of the Pittsburgh & Lake Erie Railroad. It consists of the usual smoke pipe passing through the roof, but the lower or flared end has a long trough-like opening, which is 3 ft. 8 ins. wide and 14 ft. long. The advantages of this form of jack are that smoke is conducted out of the roundhouse, no matter where the engine may be placed as long as the smoke stack of the engine comes under some portion of the overhanging funnel.

The engine is usually placed with stack just below the 30-in. smoke pipe, but if, as is often the case in roundhouse work, the engine has to be moved a few feet back or forward to facilitate repairs, the smoke still finds its way out of the shed, and when not exactly under the center of the jack, if lighting up be done, the whole shop is not made to suffer as is so often the case where jacks with small bell mouths are used.

On the roof there is a sleeve surrounding the smoke pipe and this sleeve has openings at the bottom which allow warm air to pass up. Thus the outside of the central smoke pipe is kept dry and so greatly reduces rust, with increased life for the pipe. These openings through which some warm air constantly rising, also necessarily prevents down-draughts of cold air from entering the shop.

The drip pans or troughs are made of light angle iron which hang below the side edges of the flared bottom, the drip from the end edges is provided for by a small stiffening angle acting as a gutter and sloping to the sides. The jack has given excellent results in service and is very much liked by those who have to work under it.



ROUND HOUSE SMOKE JACK P. & L. E.

Our illustration was made through the courtesy of Mr. D. J. Redding, the master mechanic at McKees Rocks.

Origin of the Cupped Side Sheet.

It is curious how inventions are repeated with no suggestion of separate origin. At various times plans have been tried to save stay bolt heads in fire box sheets from receiving direct impingement of the flame, but no decided improvement has resulted. As long ago as 1859 James Millholland, writing to the president of the Philadelphia & Reading Railroad, said: "I think, from an experiment with an iron sheet in a fire box with vertical sides, that I have hit upon a plan that will prevent the radiating cracks around the stay bolts. It is to indent the sheet at the hole the stay bolt passes through a little more than will receive the riveting at the end of the stay bolt. This places the iron in such a shape in the sheet as to allow it to spring when the expansion of the sheet and the stay bolt takes place. The experiment clearly shows an advantage from the indentation, as the opposite sheet in the same fire box is cracked and leaks, while the stay bolts in this are as perfect as the day they were put in, never having leaked at all after having been run 22,388 miles."

This was what in late years has been known as the cupped side sheet. It is passing strange that such a simple improvement has been abandoned.

In 1870 there were about 10,000 locomotives in use in the United States with 41,800 wheels and 3,900 of them had cast iron tires; 9,620 had wrought iron tires and 28,280 or nearly 68 per cent. of the whole had steel tires. The rapid advance into favor of steel for tires may be inferred from the fact that it was only ten years previously that steel tires were first introduced.

The Great Western Railway of England, have introduced gasoline motor cars for feeders to the passenger carrying business in country districts.

Braking, Breaking or Broken.

A good story of old-time braking was told the other day of an engineer running on the Ampersand & Polysyllabic Railway. The story-teller deposed as follows:

"Some years ago when air-brakes were first being adopted the A. & P. had an engineer nicknamed Modoc. Now, Modoc was supposed to be up on air-brake matters and the M. M. went out on the engine with him one fine day. Modoc rushed into the first station at high speed and brought the handle of the brake valve to emergency position. 'There's the way I do it,' said Modoc, 'everybody is at the door ready to get out; no delay.' When he got a signal to go he started the engine with a jerk—'and here is where I get my fine work in again; everybody is seated before they realize it; that's where I cut out delays.'

"It goes without saying Modoc was requested to change his ways or change his job."

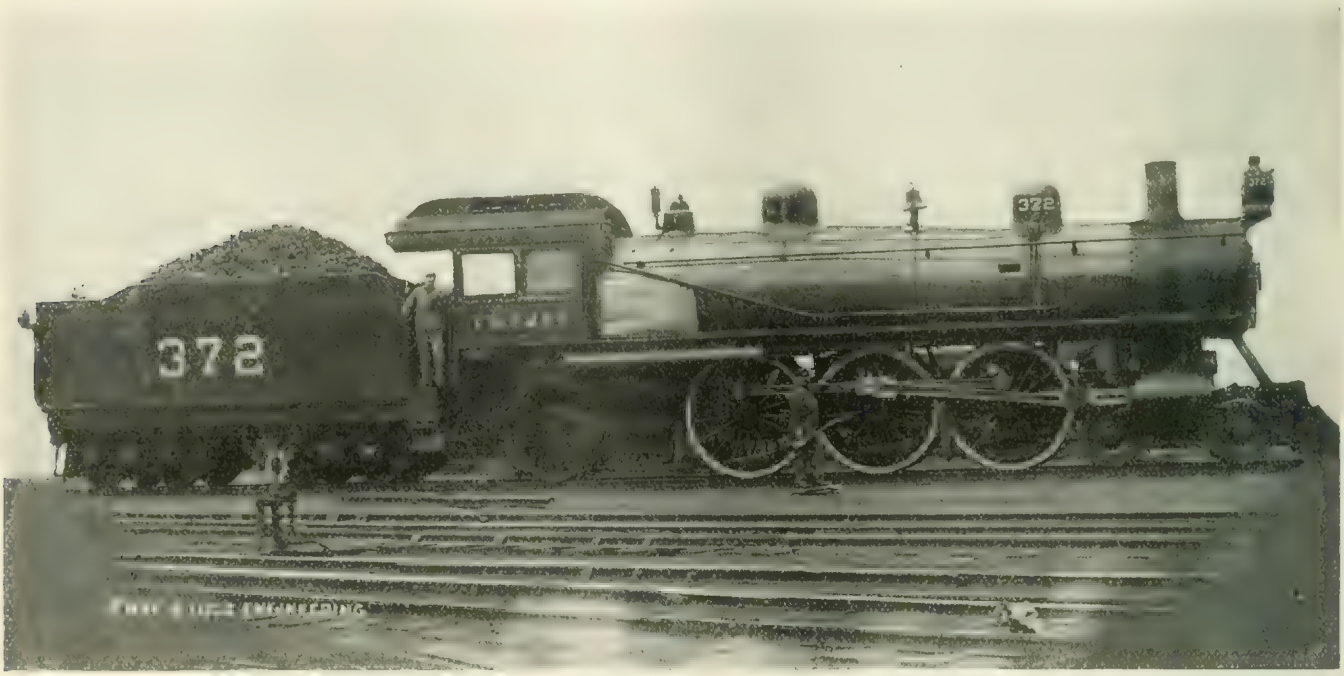
He is to-day one of the best men on handling air, on a road where the average performance is first class.

Fast Passenger 4-6-2 for the C., St. P., M. & O.

The Chicago, St. Paul, Minneapolis & Omaha Railway, of which Mr. J. J. Ellis is superintendent of motive power, has recently received from the Schenectady shops of the American Locomotive Company some 4-6-2 passenger engines. Our illustration shows No. 372 as she stands, with steam up, ready to take out her train. The photograph which is here reproduced was obtained through the courtesy of Mr. T. W. Teasdale, the general passenger agent of the road.

The engine is simple, with cylinders 21x26 ins. and the driving wheels are 75 ins. in diameter.

Weight of the engine is 192,000 pounds, of which 130,000 pounds are on the drivers, 32,000 on carrying wheels, and 30,000 on truck. The boiler is 64 ins. in diameter and has 275 flues, each flue is 2¼ ins. in diameter and 20 feet long. The fire box is 90 ins. long by 75 ins. wide and has a total heating surface of 3,425 square feet. The wheel base of this engine is 32 feet 4 ins., of engine and tender, 59 feet 6 inches, the total length of engine and tender 72 feet. The tender carries thirteen tons of coal and 6,200 gallons of water. Total weight of engine and tender is 242,000 pounds, and including coal and water 320,000 pounds. These engines are of the new 4-6-2 type and are capable of maintaining a high rate of speed. They were especially designed for getting up speed quickly in leaving stations. The total weight of the North-Western Limited Chicago train, pulled by these engines, not including engine is 410 tons.



CHICAGO, ST. PAUL, MINNEAPOLIS & OMAHA 4-6-2 EXPRESS ENGINE

To Make Brazing Solder.

There are two methods in general use for making brazing solder. By the first, rods or blocks of the desired alloy are pulverized and graded—coarse, medium, fine—and as we have quite got beyond the age of "mortar and pestel," special plant and machinery are required to accomplish this. The second method is simpler: the molten alloy is poured in a thin stream direct from the crucible into a tank or barrel of water placed in position to receive the dropping metal, about 10 ft. or 12 ft. below. Of course, there are other styles of casting solder; in some cases it is passed through a screen or strainer before falling into the water; in others it falls on to a stream of water, which is forced through a nozzle; but as there is no material advantage either way, the direct pouring is commonly employed.

On falling into the water the metal is split up into little globules, which sink to the bottom. Then the tank is emptied and the solder, before it is ready for use, gets a thorough good washing to free it from oxide.

The Baldwin Locomotive Works' Record of Recent Construction, No. 44, has just been issued. It contains some modern examples of the Atlantic, or 4-4-2 type of fast passenger power, both simple and compound. An "American" type for the Wheeling & Lake Erie is illustrated, and a number of Consolidation engines of the simple and compound variety, are shown. Several switching engines, four and six wheel, are catalogued, and inspection locomotives built for the Rochester & Pittsburgh Coal & Iron Co., and the Central Railroad of New Jersey, and a "double-ender," with a diamond smoke stack for the California Northwestern Railway. The half-tones are excellent, and are printed upon paper which is tinted inside the border line. The opposite page in each case gives dimensions, etc., in English and French.

The Kern River Power Company, of Los Angeles, Cal., has recently purchased from the Westinghouse Electric & Mfg. Co. two Type C, compound-wound, 150-kilowatt generators to be installed in its power house.

General Correspondence.

James M. Boon on Elastic Wheel Centers.

Knowing that Mr. James M. Boon, the old-time superintendent of motive power, was one of the most progressive men of his time and always well informed on railroad mechanical matters, we wrote asking him why elastic wheel centers were abandoned and have received the following interesting letter:

Referring to your letter of September 4, relative to elastic substance between wheel center and tire of locomotive driving wheels, would advise that my experience in this matter was with wooden blocks in the center of drivers and on these blocks the tire rested. This arrangement was patented by Mr. George S. Griggs, who was M. M. of the Boston & Providence road. I think N. E. Chapman, of the Cleveland & Pittsburg, had some on his road. Samuel Cummings, who was M. M. of Eastern Division of P., H. W. & C., equipped a lot of engines, and Mr. I. Dripps, of Ft. Wayne, equipped others. I was general foreman for Mr. Dripps, and had charge of the work, which consisted of the wheel centers being cast with unusually heavy rims. This rim had recesses cored into it about eight inches long and one and one-quarter inches deep. The bottom angled one-quarter of an inch, and the end slightly dove-tailed, so as to hold the blocks in place, they being driven in from the inside of the center, when the tire was in place; the block wedging itself and being held in position by wheel center.

The process of fitting up these wheels was to put the centers in the shaft and turning them so that the tire would slip in easily when cold. The wheel centers had set screws which were put in to hold the tire in position, and in case of a tire breaking to hold the pieces of broken tire from flying off. The blocks were driven in from the inside of wheel, and the outside turned and finished flush with wheel center. When the tire was in position in the wheel center, the opening for the block was wedge shaped. There were as many blocks put in as would go around the wheel center, with about one and one-half inches between the blocks. The center was not permitted to touch the tire at any point. When the tire was in position on the wheel it was turned up and blocks driven in from inside. These blocks were second growth seasoned hickory. The tires were put in position and the wheels stood up in one side, and the blocks driven home with sledges as heavy as one man could swing. The wheels were then put in lathe and tires turned for service.

The process was somewhat expensive, but when completed the job was a good one. The tires used in those days were generally iron two and one-half inches thick, and we knew that the blocks relieved the tire from the severe pounding to which it would have been subjected had the blocks not been there to relieve it. We frequently run this tire until one inch thick. As the tire was reduced in thickness it would stretch and get loose. This necessitated the shimming up of the blocks with light sheet iron and re-driving them. We never had a tire break that was running on these blocks, and though the job was expensive, we felt the results justified it.

Other plans of engines were gradually adopted and heavier wheel centers and tires were used, and the wooden blocks were abandoned. It was considered that with heavier centers and tires, and heavier rails and tracks, the blocks would not be necessary. This was never demonstrated, and the problem remains an unsolved one to this day. It has been my opinion for some time that we are overdoing the weight question, and that the gain from increased weight is very much over estimated, as I doubt whether the increased weight of rails and superstructures has been accounted for and charged up for in this increase of motive power of weight. I am of the opinion that lighter engines, moved at a higher rate of speed and kept moving, would at the end of the year show more money to the stockholders and less expense of maintenance of roadbed and equipment.

JAMES M. BOON.

Chicago, September 15, 1903.

AMIDST THE UTAH MOUNTAINS

Photographed by Miss M. J. Wilson.

Better leave undone than do by halves.—*Tennyson.*

Did Not Reflect on Locomotive Designers.

In looking over the proceedings of the Traveling Engineers' Convention, in the October number of RAILWAY AND LOCOMOTIVE ENGINEERING, I find that on page 476, second column, third paragraph, I am quoted as saying that "the mechanical men of this country are going wrong, for to-day they are building engines with 3,700 feet of heating surface to supply 17-inch cylinders."

These remarks were made as a rejoinder to a statement made by Mr. McBain, that an engine with a 19½x28 in. cylinder, and 1,915 feet of heating surface was well proportioned, and it should so appear in the report. I have too much respect and admiration for the mechanical men of this country, to make a statement that would in any way reflect on their ability, and it would be very presumptuous on my part to do so. Will you kindly correct the error through the columns of your journal, and oblige,

J. F. RODDY,
Road Foreman of Engines,
A., T. & S. F. Ry. Co.

Boiler Washing and Firing.

In order to get good results in running a locomotive: First, you want the inside of the boiler clean and kept as clean as possible. Scales on the flues retard the heat going through and the flues fom heating the water. Now they are using soda ash by putting it in the tank to break the water. That is all right to put in enough to break the water, but sometimes they overdo the thing and put in too much, it goes through the injector into the boiler and makes a very hard scale. If the boiler washers neglect their business, which they sometimes do, the scale gets thicker and thicker on the flues until there is no space between them, then it takes lots of fuel to make steam. I have found by using kerosene oil in the boiler it will soften the scale and it will come off and can be washed out. After washing out boiler put in about 8 pints of kerosene oil after putting in hand hole plates before filling the boiler, as the water rises. The kerosene oil staying on top of the water will oil the sheets, stay bolts and flues and prevent scale from sticking to them. I have used kerosene to good advantage. Sometimes the boiler washer forgets to put the oil in until he has filled the boiler, then the oil is all on top of the water. The sheets, stay bolts and flues will take up about 8 pints of oil, keeping the boiler clean makes it possible to make a good coal record. Then the fire wants to be kept clean in the fire box, the corners and sides want to be kept well filled so there will be no holes next to sheet for cold air to follow sheet up and strike flues until it is well heated. You cannot get good combustion with cold air coming up the sides of sheets; the fire wants to be light enough so it will burn free; it all helps to save coal for the company, and that is a big item. Now in regard to valve oil there is no valve oil but has more or less gummy substance in it, so all of the valve oil I use I cut with kerosene oil, about 1 pint of kerosene to 8 pints of valve oil, that keeps the cylinder packing clean and helps to save fuel. I have run cylinder packing over two years without having it looked at and when it was looked at it was perfectly clean and not one-half worn out, and did not blow only a very little when being worked around so the two openings came opposite each other. It is a good plan to give engine a light inspection whenever you get an opportunity; it is a saving of expense to the company. The old adage, "a stitch in time saves nine," is applicable to a piece of machinery as well as to a garment. WILLIAM SHACKLEY.

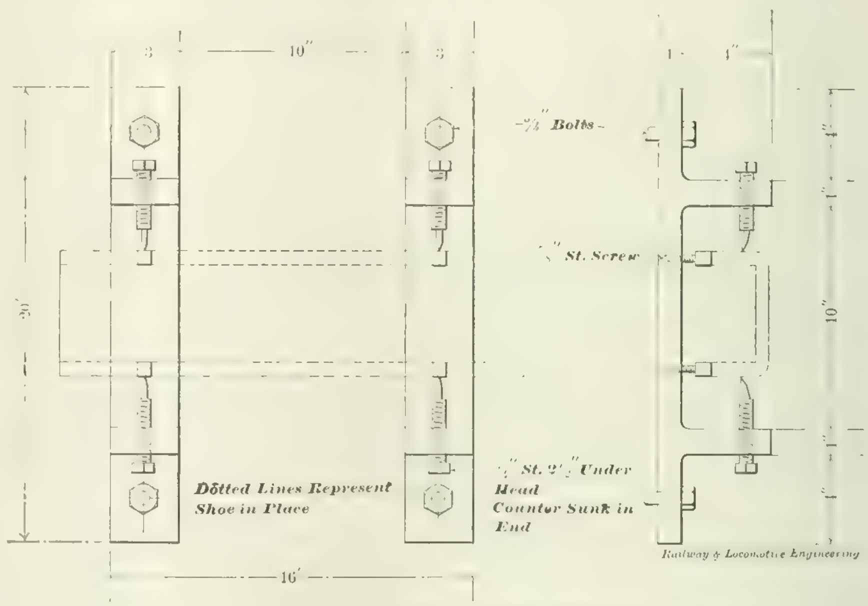
Omaha, Neb.

Percy's Shoe and Wedge Holder.

Enclosed you will please find a drawing of a shoe and wedge holder. It is one of my latest designs and I have used it for three or four months now and it is the best I have ever used. I have used various kinds of shoe and wedge holders but this one meets more of the requirements of a holder than any other I have seen or used, inasmuch as it does away with the small wedges used to raise and lower the corners. Then, beside, when the wedges are used a heavy cut will disturb them and a second setting is necessary before taking finishing cut, but when shoe or wedge is set up and fastened in place in this holder there is no resetting, as the set screws under the corners hold it up in place and the four spurs hold it down on the set screws.

Then again, if a shoe or wedge has to be skimmed off again on account of engine not tramming, the operator places two parallels between or outside of each holder, then turns shoe or wedge up-side-down on parallels and skims flanges, then turns over and takes off the required amount. This last operation with the parallels saves the time of setting again to pop marks.

This holder can also be used to hold guides while being planed. The two pieces of holder are separated to any required distance and by placing parallels under guide (as in skimming off shoe) we then hold the guide in place with the four spurs.



PERCY'S SHOE AND WEDGE HOLDER

I hope this will find space in your valuable paper and be of some value to some of your readers.

JOHN W. PERCY.

So. Tacoma, Wash.

The Nickle Plate.

I attach a clipping from an article from your pen which I found in a recent number of the RAILWAY AND LOCOMOTIVE ENGINEERING, in which I was much interested, but wish to make a statement with regard to the name "Nickle Plate." During the winter of 1882 I was operator on one of the Pennsylvania lines about 40 miles from Cleveland, to which point the road in question had just been built, or at least not very long before. The first time I heard of it it was called the "Nickle Plate," and I remember distinctly of asking my informant why it was so named, and he replied that the character of the road and the elegance of equipment were to be such that it was to be worthy of

that name. Your account in the article to which I refer would place the origin of the name about 1889.

Of course this is not a vital matter, but in the interest of truth may we not look for another source for the name which has become so popular? H. A. DALBY.

A Floating Test Plant.

The subject has been brought up as to a testing plant for merchandise cars loaded in New York City and placed in a train at Jersey City and sent by fast freight to some western point. When the car arrives in Jersey City it is usually hurriedly placed in a fast train which has been held for it, and very little, if any time is had to repair and test the brakes. In this case a car going into a high-speed train is obliged to do so with less preparation than a car traveling in a slow freight train, which is absurd and out of reason.

Quite some time ago some of the railroad floats plying between New York City and the Jersey City roads were supplied with a hand pump, and a man was sent over from the Jersey City yards to the float in New York City to pump up the cars on the float with a hand pump and test them while they were being loaded at the dock in New York City. This was an extremely laborious and primitive procedure, and what little testing the brake got was at a comparative low pressure, as the hand pump required too much elbow grease to get up to the ordinary 70 pound train line pressure. Having in mind this primitive practice, and the medium results acquired, and the possibility of a much better system along similar lines, it has been suggested that some arrangement be made whereby air pipes can be run along the docks and connected by rubber hose to the cars on the float, thereby giving pressure with which the brakes can be tested on the float.

After the cars have left the float in Jersey City they can be placed in a train at once without any further test, and be relied upon to reach their destination without further repairs except such trifling ones as may develop en route. I have thought that some plan like this could be arranged, and if so would it not contribute largely to the maintenance of brakes in fast freight service?

P. J. ELKERSON.

Middletown, N. Y.

A common expression among railroad men about certain classes of locomotives is, that they are over-cylindered. A more correct description would be that they are under-boilered. The practice of putting on heavy cast iron decks to increase the weight was amazingly bad engineering when increasing the size of the boiler would have given increased weight and steam making capacity.

The Reality of a "Practical" Opinion.

BY A. O. BROOKSIDE.

A gentleman with an eye to originality, by name Mr. Lenden Ear, was recently given the position of fifth vice-president and general purchasing agent on the Once Burnt & Twice Shy Railway, with headquarters at Buytown. Mr. Ear succeeded a man who in this position had been exceedingly conservative and who had believed in investigating the merits of any new device before committing himself to its extensive purchase, and who had always been open to hear what those who had to use material on the road had to say about it as to quality or effectiveness as the case might be.

The new 5th vice thought that this conservative policy had been carried too far, and he believed in having an opinion of his own and not going by what was told him all the time. He thought that "the men" on the road had altogether too much to say about what they wanted or about what they liked, so he inaugurated the "use-what-I-buy" policy. When Harding Steel, the general foreman, got his M.M. to recommend the A-1 company's upsetting machine, and the "old man" had put his signature to the requisition, Lenden Ear bought a machine from the Just-as-Good Company and complacently said, "They can't run me."

By and bye a salesman from the Embryo Supply Company came to see Mr. Ear and showed him the model of a new car jack which would do the work of two ordinary ones. Lenden Ear was quite delighted because the supply man showed him how well the model worked, lifting a couple of books on the office desk, and appealed to him as a "practical" railroad man and "one who could judge for himself." The jack was a hydraulic one, large and very good of its kind, with a very broad base and a kind of bar or a T-shaped top which was supposed to engage with the end sill of a car on each side of the coupler, and so raise one end in order to put in wheels or do other work. It was just as if you took an ordinary jack and put a heavy bar of iron on top, and allowed it to rock slightly so as to adjust itself to any slant of the end sill. Of course the jack in question had this bar made of steel, of peculiarly strong section, with both extremities roughened so as to avoid slip. This was, however, the fundamental idea which the "inventor" had in view when he "designed" the jack. Perhaps you may wonder why such a thing could be seriously brought out, and that sensible men would bother with it, but it had been invented by some friend of the Embryo company with more cash than gray matter, and besides, gentle reader, let me tell you what perhaps you already know, that several railways much better than the O. B. & T. S. have had foolish schemes forced along by officials until the schemes fell down as they were bound to, at last.

Well, as for the jacks, when you wanted to put in a pair of wheels all you had to do was to use one of the Embryo car lifters (they were not styled jacks) placed so that the T-shaped top took the end sill each side of the coupler, give a few strokes of the lever and up goes the car. The old way required two jacks, so there you are.

The supply man begged Lenden Ear to go out into the yard and actually see one operate, and then he would know as much and more than "the men" could tell him. Lenden Ear and the supply man went out and tackled an empty flat car. The Embryo man put the jack squarely under the center of the end sill, which by the way was made of wood, and jacked up the car easily. He stood smiling on Lenden, one hand in his pocket, and the toe of his right foot touching the ground beside the instep of his left, just as if he was a sailor being photographed for the first time, and he said, "You have had a practical demonstration and you can appreciate it." Lenden Ear went back to the office and placed an order for twelve Embryo jacks, and in due time they arrived, painted a beautiful shade of bottle green, and Lenden Ear had them issued for use.

When half a dozen found their way to Harding Steel's shop, he turned them over to the car foreman, remarking at the time that they were no good. The car foreman said he shared that opinion but would give them a whirl. He therefore put Billy Boyd, a good square fellow and a good car man, to jack up a loaded car and see how it worked. Billy read the directions which were tied to the T-shaped top, and placed the jack squarely under the coupler with the T arms set for the end sill. He then began to pump and the car went all over to one side. "Hello," said the foreman, "just as I thought—move the jack to the right." Billy did so, and on jacking up again the car went over the other way. "Too far, Billy, come in again!" Billy "came in" but it would not balance until he "came in" some more and then the car began to go up, but the jack was not under the center by any means. "Eight minutes setting it for a load," said the car foreman to Harding Steel that evening, and Steel told him to put them on one side until further orders.

About a month or six weeks after this, Lenden Ear came down to the shop and dropped into the office of the "old man." They talked about the weather for the thirty-second part of a minute and then Lenden asked him how much saving he had effected by the use of the new jacks. He did not ask if any saving had been effected, he asked "how much." He was told no saving had at any time been

within a thousand miles of the jacks as they now stood. When asked for particulars the "old man" said, "I have a report which though it passed through the proper channel all the way up, started with Billy Boyd and the car foreman." They said that with an unevenly loaded car it took too long to place the jack, and it wasn't safe anyway, because you never could tell how near it was to "balancing off again," that was probably Billy Boyd's expression, but although it did not read well in a letter, Billy had eternal truth on his side, when he manufactured it. The "old man" also said that he had a letter from the M. M. at the other end of the line who had received the other six Embryo jacks saying, "One of our car men tried to jack up a loaded steel hopper with one 'Embryo' and had only succeeded in slightly bending the lower flange of a very light steel end sill before we caught him, and I have had the jacks set on one side awaiting further orders."

Lenden Ear at first said "prejudice," and thought "the men" were very stupid and very pig-headed and had clubbed together to "down" the jack. The "old man" tried to cheer Lenden up a bit by saying that "the men" had not been clubbing together because the jacks had not given satisfaction in the service which they would have to be put to by the practical men who had to use them, and live with them, and make them work, and "take chances" with them—men like Billy Boyd and the car foreman. The "old man" said, however, that Harding Steel that morning had asked him through the M.M. to let the shop have those jacks as they were no good outside and he would put on an ordinary top and make the valves work a little better, and they would be all right, and the old man said he had given his permission as the G. M. might be "along" some day and ask questions if he saw a row of new jacks "on the side track."

Lenden Ear began to see that the "old man" and "the men" were not the headstrong, prejudiced, self-opinionated lot he had taken them for, and as the "old man" expounded unto him the law and the prophets he began to see daylight, and to understand that though he might order things the men who used them daily could make or mar his reputation as a buyer. He thereafter became a useful and considerate official, and in time he came to respect the judgment of Billy Boyd, on anything which Billy had to work with day in and day out and to keep in repair to make his living with, because, as Billy once explained to him, he wanted a thing to be "handy and good and safe because he wasn't railroading much for his health."

Moral: Two or three drops squeezed out of the opinion of some honest, capable men who have gone up against it good and hard, in all weathers, outside, and who don't know what a railroad looks like over the top of a mahogany desk in a steam-heated office, should now and then be poured on a requisition form, and if the ink does not fade out, it's likely all right.

Only Trying.

A traveler mustered up courage to ask when his train was due.

"Nine fifteen," said the agent.

OLD BELGIAN ENGINE. WIDE FIRE BOX PROTOTYPE OF A POPULAR MODERN CLASS.

He waited a half hour and then went back to the window.

"Train ain't here yet, and it's 9.30."

"What are you going to do about it?" asked the ticket man.

"You've got it marked 'on time' on the board."

"Bet you $1 I ain't."

"Then I'd like to know what 'O. T.' stands for."

"'Only trying.' It's a mixed train, and they're trying like Sam Hill to get over a grade fifty miles from here with twenty cars of stock. But don't you worry; they'll get here some time to-day. They'll keep trying till they get over the hill."

The note taker had been making the rounds of the veterans listening to their reminiscences of early railroading. At the conclusion of a long series of interviews he complained that most of the pioneers were afflicted with inventive memories.

Things cannot turn up of themselves. We must in a measure assist them to turn up.—*Mrs. Micawber.*

Old Time Railroad Reminiscences.

BY S. J. KIDDER.

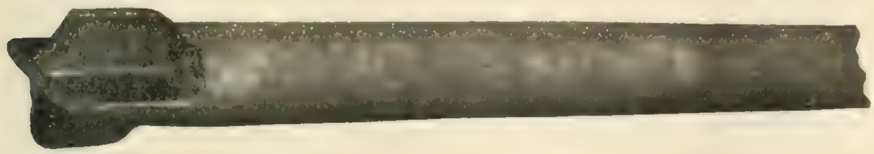
I am sometimes inclined to believe that new appliances or inovations, when introduced on railroads, are not properly appreciated by the employees who more or less generally seem to think that the employment of devices differing from those with which they have become familiar are of needless or doubtful utility, when to their way of thinking the older ones have worked all right and are good enough. With such thoughts it is little wonder that the engineer who indulges them is inclined to overlook the fact that progression and perfection are the levers which impel the business of the world and safety as well whether it be in the form of a railroad train, safety appliance or any form of contrivance intended for profit or the comfort or safety of the man who handles the novelty or those dependent on him for their well being.

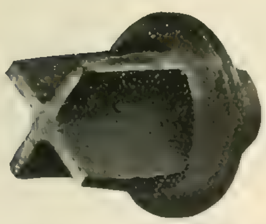
It is very fair to assume, and observation and experience has very generally proven, that when a railroad company has adopted something new and the adoption of which must necessarily be attended with more or less expense, that its merits over existing appliances have been carefully considered before making the change, hence instead of taking the position to "let well enough alone" the better way would seem to be to become familiar with the device, when its forthcoming is a settled fact, with a view of promoting its valuable features. We can all recall how universally engineers protested against injectors in lieu of pumps, automatic lubricators and other devices, and in too many instances contributed to their apparent unreliability and uselessness by neglected effort to become familiar with and how to operate them, but in time were forced to admit that their merits were superior to the apparatus supplanted and after all had been opposing the natural fruits of evolution which later they were compelled to concede were steps in the way of improvement and most desirable.

It was always my way of thinking that when aything new was in sight that those sure to come in contact with it sooner or later should leave no stone unturned to familiarize themselves with it before it came under their immediate control and thereby save perhaps lots of vexation and possibly dire results. I am led to these thoughts by an experience with automatic brakes where knowledge I possessed at the time of the incident prevented an accident, but before reciting it will refer to experiences connected to and leading up to it.

For years we had been using the straight air brake on the C. B. & Q. on all passenger trains, and during that period I had never experienced a brake failure at a critical moment, though had

several times when approaching a stopping place or descending grade, in testing the brakes found the hose couplings disconnected somewhere in the train, but by this practice at such times had ample room to stop and avoid, in two instances, head end collisions where the opposing train happened to be occupying the main track unexpectedly at a station, by the vigorous application of hand brakes. Hence when it became noised about, as such things do, that our passenger equipment was to be provided with automatic brakes which could not fail, I was only too glad and anxious to see the work completed. This, I think, was in 1882, and my engine was among the first in the division to receive the new equipment. Having the smallest passenger engine, I was frequently sent out on specials, composed of officers' cars, they also being among





EVOLUTION OF THE AIR PUMP VALVE.

the first of the coaches to be changed to the new brake, and on these trips it was my practice to cut the engine and cars into automatic and use that brake while on these trips. With this experience and a book containing a general description of the apparatus, literature on the subject at that time being extremely limited and no air brake instructor to appeal to, I was able to gather considerable knowledge of the brake's operation, while at the same time I understood little of the philosophy which contributed to the results I found myself able to obtain by proper brake valve manipulation. For instance, by lapping the brake valve when approaching a stopping point the brakes released more freely than otherwise, the three-way cock of that period not being arranged for obtaining excess pressure.

Had also observed that a 20 to 25-pound reduction of train pipe pressure appeared to apply the brakes to their full efficiency and ensured a prompt release. These and other features were apparent, and while imperfectly understood were found to promote desirable results and prevent troubles generally believed to be inherent defects of the brake.

With these experiences I had been able to become fairly familiar with automatic brakes, and when a bulletin was posted in the round houses to the effect that on a certain day and hour all trains would leave terminals with brakes working automatically I felt a certain degree of security that I would be able to get along all right with them. This was before the days of pump governors and to prevent carrying an excessive pressure a safety valve, set at 70 pounds, was attached to the main reservoir of engines on our division.

The time for our initial trip was approaching, and pretty soon Jim Brown came rolling into Burlington with the 175 carrying 100 pounds train line pressure, and when the 245 was coupled to the train of course all train brakes set with a bang, and while the passengers were at supper I took advantage of the time in bleeding the auxiliary reservoirs to a point which would permit control of the brakes with my more modest pressure.

We soon pulled out with our six-car train, and afer two or three stops, two cars being the most I had previously handled, I had properly gauged the exhaust from the brake valve and the brakes worked quite to my satisfaction.

Thirty-one miles up the road was Ketchum's Siding, a flag station, and four miles beyond, down a heavy grade, Rome, the regular meting point for an opposing passenger train which, by the way, had the right of road. At the Ketchum whistle post I sounded the station signal, and receiving no response from the cab bell, indicating a stop there, I let the 245 sail along, and as we passed the switch the brakes suddenly applied and before I recovered from my astonishment the train came to a stop with a terrific jerk, the main reservoir and train pipe pressures meantime vanishing.

Too late to save the reservoir pressure I recovered my senses, and when "Goldy," the conductor, came up to ascertain why I did not respond to his go-ahead signal, I learned he had pulled the conductor's valve cord to see how the thing worked, and abundant success had certainly crowned his efforts. The delay incident to restoring the pressure with a 6-inch pump resulted in a lay out and our waiting at Ketchum for No. 4. Following this everything worked very smoothly for the following two days, when the incident happened that proved my knowledge of automatic brakes was the one thing which prevented what, without question, would otherwise have been a most deplorable accident.

It was a beautiful August night, about 10 o'clock, with a full moon, and we were going east on No. 4 and had reached West Burlington, where a slight delay had been encountered, necessitating a quick run down the 52-foot grade, to reach our destination on time, the grade extending from our stopping point to Burlington.

As we pulled through the yard I noticed a heavily loaded freight train waiting to follow us down the hill. We had gone some three miles, and just as I reached for the brake valve to slow up the train before passing several street crossings the brakes suddenly applied, and hearing air escape under the tender deck I knew from former experience that the hose between the engine and tender which, by the way was simply clamped to the air pipes, had pulled off. My first thought was that no one on the train knew anything about releasing brakes under such conditions; the next that in a few moments that freight train, dependent on hand brakes alone, would come thundering down the grade at a high rate of speed, such as is usually considered safe when following a passenger train, and with no time on our part to get back a flag, owing to the long Sunny Side curve obscured from view not far in our rear. These thoughts passed my mind in an instant and, jumping from my seat I crossed the cab deck, descended to the tender step and waited for the train to slow up sufficiently to permit my alighting without being compelled to perform any acrobatic contortion. When the train had slowed down to a speed of perhaps 15 miles an hour I jumped, and after taking a number of strides that would have resembled those of an ostrich in rapid movement, I finally got stopped and headed west then sprinting to the best of my ability, was opposite the fourth car when the train came to a standstill. I immediately dove under the car, throwing the 4-way cock to straight air, it was in the days of plain triple valves, then out again for the next car, until the Pullman was reached at the rear of the train.

Then turning towards the front of the train, running from one car to another at my best sprint, manipulating each triple as I passed it, I soon reached the en-

gine. During this time the conductor and brakeman were standing on the platforms inquiring as I passed what was the matter, but too much hinged on the facility of my movements to satisfy curiosity. Jumping aboard I pulled out wildly, and just as I did so heard several frantic whistles for brakes and saw the headlight of the old 256 rapidly closing up on my tail end.

As we approached Mt. Pleasant crossing, my train at this time covering a curve, I looked back, and as I did so saw the headlight pass out of sight behind the Pullman, we at this time moving, perhaps, 30 miles per hour. Bracing my shoulder against the back board and grasping the reverse lever I prepared for the shock, but not receiving it looked again and saw that the headlight was in sight and receding from our rear.

The relief experienced at that moment can hardly be described, and when assured, a few moments later, that the freight was under control and the distance between us rapidly increasing, I shut off, whistled for brakes and not long after was brought up safely by the hand brakes at Union station.

Now, some of my readers no doubt will attribute this narrow escape to a streak of good luck, but I do not think so, for had it not been for the knowledge I had gathered regarding the automatic apparatus we would have been struck by that freight train, moving at a speed of at least 40 miles an hour, and it can only be conjectured what would have been the result to the 127 passengers at the time aboard the train, and who little realized the narrow escape they had had from disaster. My efforts to avert an accident were never rewarded by a medal or other insignia of gratitude on the part of the railroad company, but it impressed me more firmly than ever of the importance of men handling trains familiarizing themselves with new devices they are to come into contact with, as such may result in protecting themselves, as well as the lives and property under their charge from accidents which, when they occur, are so apt to be attibuted to hard luck.

Did I say no insignia followed my efforts to protect the company's interests and property? Well, I hardly meant it that way, for shortly after I did receive one in the form of a telegram, over the signature of the general manager, summarily "firing" me from the service of the company, the details of which will be given in a future number of RAILWAY AND LOCOMOTIVE ENGINEERING.

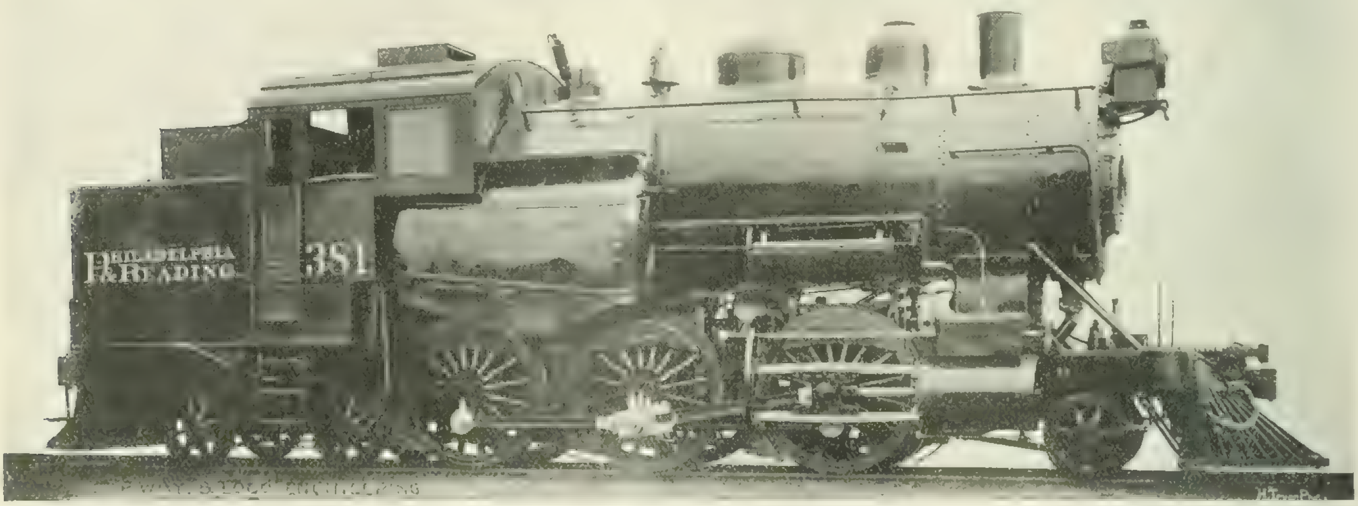
A Suburban P. &. R.

The accompanying illustration is of a simple, wide fire box, slide valve suburban locomotive recently built by the Baldwin Locomotive Works for the Philadelphia & Reading Railway, of which road Mr. S. F. Prince, Jr., is the superintendent of motive power and rolling equipment.

The engine has 20x24 ins. cylinders and the driving wheels measure 61⅝ ins. outside tires. The tank and coal box is carried on a rear projection of the main frame and the wheel arrangement therefore makes it a 2-6-4 type. The reverse lever, unlike those in general use, is one which in text books on elementary mechanics would be called a lever of the first class. That is, the fulcrum is situated at some point between where the power is applied and where the resistance acts. This gives a backward motion to the reach-rod when the lever is thrown forward. The reach-rod however passes beneath the level of the lower frame-bar and operates a tumbling-shaft arm which hangs down from above. This arrangement compensates for the backward motion of the reach-rod in this case and lowers the links so that, when the reverse lever is thrown forward, the engine moves ahead in conformity with usual practice. When the reverse lever is thrown back the links are raised and the valve gear is operated by the back-up eccentrics.

The main drivers are the only wheels not flanged. The springs are on top of the boxes and the pony truck and leading driver are equalized together, and the main and trailing drivers are also equalized together.

The boiler is 66 ins. diameter at the smoke box end and is of the wagon top type. There are in it altogether 1,981.8 sq. ft. of heating surface, of which the tubes give 1,825.5 sq. ft. The grate area is 68.5 sq. ft. and the fuel is anthracite buckwheat There are 447 tubes 9 ft. long, diameter 1¾ ins. The auxiliary dome carrying the pop safety valves is so placed as to require the whistle, which has a long top, to be set at an angle in order not to stand above the level of the top of the smoke stack.



PHILADELPHIA & READING 2-6-4 FOR SUBURBAN TRAFFIC

The tank has a capacity of 3,000 U. S. gallons and the fuel space will hold 7,500 lbs. of the kind of coal used. The total weight of the machine is 201,700 lbs., the drivers carrying 120,860 lbs. There are 19,120 lbs. on the pony truck in front and 61,720 lbs. on the rear truck. The steam pressure carried is 200 lbs., and the calculated tractive effort is about 26,500 lbs.

A few of the principal dimensions are appended for reference:

Cylinder—20 x 24 ins.

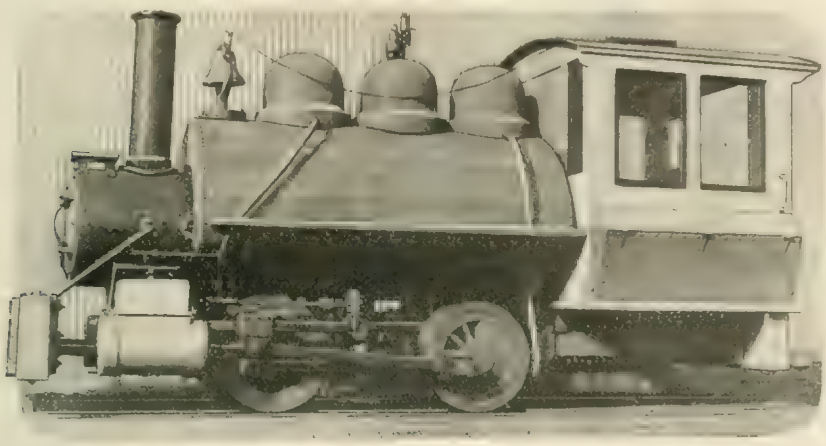
Boiler—Dia., 66 ins ; thickness of sheets, 11/16 in. and ¾ in.; working pressure, 200 lbs.

Fire box—Length, 91 ins ; width, 105 ins ; depth, front, 59¼ ins.; back, 46¾ ins.; thickness of sheets, sides, ⅜ in.; back, ⅜ in.; crown, ⅜ in.; tube, ½ in.; water space, front, 3½ ins.; sides, 3½ ins.; back, 3½ ins.

Tubes—Material, iron, wire gauge, No. 10, number, 447; dia., 1¾ ins.; length, 9 ft. 0 in.
Heating sur.—Fire box, 156.3 sq. ft.; tubes, 1,825.5 sq. ft.; total, 1,981.8 sq. ft.; grate area, 68.5 sq ft.
Driving wheels—Dia. outside, 61 ins., journals, main, 8½ x 12 ins.; others, 8½ x 12 ins.
Engine truck wheels, front—Dia., 30 ins.; journals, 6 x 12 ins.; back, dia., 33 ins.; journals, 6x 12 ins.
Wheel base—Rigid, 12 ft. 6 ins.; tot. eng., 30 ft. 0 ins.
Weight—On driving wheels, 120,860 lbs., on truck, front, 19,120 lbs.; on truck, back, 61,720 lbs., total engine, 201,700 lbs.

Engine of a Trans-Mississippi Shop.

The small switching locomotive here illustrated was built by the Davenport Locomotive Works, of Davenport, Iowa. That company seems to have crept very quickly into a fair business in building small locomotives, for they have turned out 52 engines since last November and have done some repairs for railroad companies. This is the first company that we know of that has established a business of building locomotives west of the Mississippi River. The officials of the company are: E. S. Johnson, president; J. Flick, vice-president; Alfred Hagenboeck, secretary; C. L. Grimes, general manager. George Strahle, who learned the machine trade in the Burlington, Cedar Rapids & Northern Railroad Shops at Cedar Rapids, Iowa, is general foreman.



ENGINE BUILT WEST OF THE MISSISSIPPI RIVER

Cured by a Letter.

A few months ago the son of a railway director was, through his father's influence, given a position of some importance on a large railway. He was fresh from Cambridge, and in the orders which he from time to time issued to the men under him always made use of the longest, most unusual words. This habit led to some rather expensive blunders, and the matter coming before the general manager, he wrote the young official the following letter:

"In promulgating your esoteric cogitations and in articulating your superficial sentimentalities and amicable philosophical or psychological observations, beware of platitudinous ponderosity. Let your conversational communication possess a clarified conciseness, a compacted comprehensibleness, a coalescent consistency, and a concatenated cogency. Eschew all conglomeration of flatulent garrulity, jejune babblement, and asinine affectation. Let your extemporaneous descantings and unpremeditated expatiation have intelligibility and veracious vivacity without rhodomontade or thrasonical bombast. Sedulously avoid all polysyllablic profundity, pompous prolixity, psittaceous vacuity, ventriloquial verbosity and vaniloquant vapidity. Shun *double entendre*, prurient jocosity and pestiferous profanity, obscurant or apparent. In other words, talk plainly, briefly, naturally, sensibly, purely and truthfully. Don't put on airs; say what you mean; mean what you say; and don't use big words."

No letter was ever sent out afterward by the young railroader which contained words of more than two syllables.

Water Softening on the Pennsylvania Lines.

Among the many improvements recently inaugurated on the Pennsylvania systems, not the least interesting is in the matter of water softening for locomotive use. A typical installation for this purpose on the lines west of Pittsburgh, northwest system, is located at Middlepoint, Ohio, where a machine of capacity to soften 10,000 gallons of water per hour has been in use for some time. The water to be treated is particularly bad, yet the softening and purification are practically accomplished.

The chemicals used in the softening are fresh lime and soda ash, and this particular water requires for treatment approximately 4.75 pounds of lime and 4.5 pounds of soda per thousand U. S. gallons. Running at full capacity, 1,744 pounds of incrusting calcium and magnesium salts are removed per day by the machine employed.

In its slow upward progress in the tank the water dissolves a sufficiency of calcium hydroxide and becomes saturated lime water. Owing to the absence of agitators in the upper portion of the tank, the liquid there is comparatively quiet, and by the time the exit is reached all the heavy particles of milk of lime have been left behind by the lime water, which issues clear and of constant strength. Flowing through the chute it meets the main body of raw water from the gate as well as the proper proportion of soda ash solution which has previously been prepared in the box. The soda solution is fed by means of a valve which is so constructed and automatically operated that the flow of solution is always proportional to the amount of water to be treated. The water and the reagents then pass downward through the reaction pipe into the reaction tank. This tank is of such a size as to permit the water to remain in it for a period of half an hour, during which time it is very thoroughly agitated by means of stirrer bars on three vertical shafts. The precipitate subsides to the bottom of the settling tank; the treated water rises slowly and passes through a wood fiber filter, where the very small quantity of matter which is carried in suspension, is deposited. The water then flows clear and soft from the outlet to the storage tank.

The builders of this plant, Industrial Water Company, of 126 Liberty street, New York, have also installed another plant of a like capacity and treating water of the same general character at Washington, Hardin County, Ohio, about forty miles farther east on the same railroad.

It is gratifying to note of late the peaceable manner in which the railways and brotherhoods are adjusting their grievances. This has been made possible by the Brotherhoods, in their wise selection of conservative committeemen, who have been able to demonstrate to the officials of railways the fairness of their requests. On the Great Northern, after a conference lasting several weeks, the engineers and firemen got a raise of pay and a reduction in working hours for the men on the switchers. On the main line the firemen got a raise of pay, ranging from 5 to 15 cents per hundred miles, according to the class of service.

In a time book for engineers on the South Carolina Railroad dated 1835, there are a few rules about the pay of engineers. Among them is one which provides that when an engine broke down and returned without finishing the trip, the engineer would not be entitled to any pay.

The Northern Pacific are receiving seventy-five engines this year. There are sixty-five road engines and ten switching engines in this "batch" of new motive power equipment.

Railway and Locomotive Engineering

A Practical Journal of Railway Motive Power and Rolling Stock.

Published Monthly by

ANGUS SINCLAIR CO.,

174 Broadway, New York.

Telephone, 984 Cortlandt.
Cable Address, "Loceng," N. Y.
Glasgow, "Locauto."

Business Department:

ANGUS SINCLAIR, President.
FRED M. NELLIS, Vice-President.
JAMES R. PATERSON, Sec'y and Treas.

Editorial Department:

ANGUS SINCLAIR, Editor.
F. M. NELLIS, GEO. S. HODGINS, JOS. A. BAKER, Associate Editors.

Advertising Department:

Eastern Representative, S. I. CARPENTER, 170 Summer St., Boston, Mass.
Western Representative, C. J. LUCK, 1204 Monadnock Block, Chicago, Ill.

British Representative:

THE LOCOMOTIVE PUBLISHING CO., Ltd., Amen Corner, Paternoster Row, E. C., London.

Glasgow Representative:

A. F. SINCLAIR, 7 Walmer Terrace, Ibrox, Glasgow.

SUBSCRIPTION PRICE.

$2.00 per year, $1.00 for six months, postage paid to the United States, Canada and Mexico. For other parts of the world, $2.50, or ten shillings. Single copies, 20 cents. Remit by Express Money Order, Draft, Post Office Order or Registered Letter.

Mailing address can be changed as often as necessary—always give old and new address, and if you subscribed in a club, state who got it up.

Please give prompt notice when your paper fails to reach you properly.

Entered at Post Office, New York, as Second-class mail matter.

Attempts to Improve Locomotive Valve Motion.

We once read a statement made by a celebrated engineer that cylinder clearance is always a source of loss, a statement which appears to be thoroughly endorsed by Mr. Ira C. Hubbell, who read a paper at the September meeting of the New York Railroad Club on "Effects of Cylinder Clearance Upon the Quantity of Steam Consumed in Doing Specific Work, With Special Reference to Locomotive Practice." With the shifting link motion arranged to increase the lead as the cut-off is shortened, there must necessarily be considerable clearance space provided to hold the compressed steam, and Mr. Hubbell contends that the work of compression is wasted effort which could be avoided by employing a valve motion that would keep the exhaust port open till near the end of the stroke and thereby leave a small amount of steam to be compressed. He submitted indicator diagrams taken with the Allfree Valve Gear, and they certainly exhibit almost ideal steam distribution. Link motion engines cannot be operated smoothly with less than eight per cent. piston clearance, which makes a large hole to be filled at the beginning of each stroke. A material reduction of this space ought to result in steam saving sufficient to effect a marked economy on the operation of a locomotive.

The indicator diagrams illustrating Mr. Hubbell's paper would lead us to believe that the claim for the valve motion producing them has the merit claimed for it. The valve movement is so timed and arranged as to not only delay opening and closure of the exhaust ports at the early points of cut-off, but at all points of cut-off, so that these events do not occur until the piston is within about three inches from the end of its travel, regardless of the point of cut-off. With such action the clearance, including the space clear of striking and that beneath the valve faces, is reduced to about 2½ per cent. without disturbance to the moving mechanism.

The author of the paper cited calculations to show the saving that would be effected, with an engine having cylinders 20x26 inches, and theoretically he proves a good case. We have enjoyed considerable experience in making and watching tests of locomotives with valve motion designed to improve on the link motion. That experience makes us skeptical about the real steam saving that will result from a valve motion producing ideal diagrams; but the diagram ought to point the way toward real progress, and act as a guide to improvement.

The link motion attained popularity owing to its durability and simplicity, two features that are of the highest importance in locomotive mechanism; but it is possible to over-estimate their value. As a mechanism for steam distribution, the link motion is very defective and it is possible that its shortcomings overbalance its merits. The ordinary link motion when tested by the indicator, always displays excessive compression at short points of cut-off, at the points where most locomotives are worked the greater part of the time. When fault is found with this peculiarity, the admirers of the link motion explain that the high compression is necessary to produce smooth running at high speeds and that the action fills the clearance spaces and thereby saves steam from being drawn from the boiler to produce high initial pressure at the beginning of the stroke. Most of them also believe that the act of compressing the steam costs nothing, which is contrary to all nature's laws, and to the principle of the conservation of energy. They say it costs nothing to arrest the swing of the moving parts, which would otherwise expend their blows upon the frames and pedestals; but the absorption of the blows cuts off the heel of the indicator diagram, and thereby wastes part of the power, or, rather, reduces the cylinder capacity. When the heel of the diagram is materially increased by reduction of compression a proportionate increase is given to the power of the engine.

It seems to us that the ideal valve motion, is one that makes a low percentage of cylinder clearance possible and provides for only sufficient compression to raise the compression to steam chest pressure at the beginning of the stroke. This, of course, would call for something better than the link motion.

It may be that the valve motion advocated by Mr. Hubbell fulfils these conditions. The fact, however, that it produces an ideal indicator diagram, will not signify conclusively that it is destined to displace the link motion.

Valve motions with independent cut-off were used very largely before the link motion forced its way into popularity; and some of them produced remarkably good steam distribution. George H. Corliss applied his famous valve motion to a locomotive, but it proved the worst kind of a failure. David Clark, of the Lehigh Valley, designed a valve motion which produced indicator diagrams very like those taken from Mr. Hubbell's motion, but the engines did not use less coal than those having the link motion. All railroad men are familiar with the repeated struggles engaged in by George S. Strong to produce a valve motion that would be superior to the link, but he failed. Then there was the Stevens' valve motion used on the Southern Pacific, which seemed ideal in every respect, so far as making indicator diagrams were concerned; but the influence of its inventor who was superintendent of motive power of a great railroad system, could not make it displace the the link.

In 1889 William Wilson, superintendent of machinery of the Chicago & Alton Railroad, made exhaustive trials of a radial valve motion of his own design, which had separate exhaust valves which could be adjusted to open and close at the points best calculated to effect saving of steam. It was a splendidly designed valve motion and thoroughly practicable as a valve operating mechanism. The engine worked admirably but those with the link motion did the work more economically, a fact which was reluctantly admitted by the clever inventor of the motion.

People who have watched with sympathy the attempts to improve the valve motion of the locomotive are rather mystified by the failures that have overtaken all attempts to produce a motion which would correct the admitted faults of the link motion, and do the work on a smaller volume of steam. As the cylinders of locomotives are peculiarly susceptible to chilling influences, with resulting excessive cylinder condensation, it may be that the high compression may perform useful functions in heating up the cylinder thereby preventing loss of heat. As the locomotive is abnormally over-cylindered to give it great starting power, it may be that the excessive compression acts to automatically reduce the cylinder capacity at a time when a smaller cylinder is sufficient

for the work to be done. In that case, cutting off the heel of the indicator diagram is gain instead of loss. It might be argued that an earlier cut-off would reduce the capacity of the cylinder, but that again would increase the evil of condensation, which is no imaginary source of heat waste.

The history of attempts to improve the link motion out of use, does not inspire us with hopes that the vanquisher is yet in sight. It may be, however, and Mr. Hubbell has worked so intelligently and persistently that his motion deserves to come out the victor. Other successes have been attained after years of failure and this may be another case where intelligent perseverance will be ultimately rewarded.

Stock Investing by Employes.

In these days when the diverse interests of capital and labor threaten to prostrate many industries the fact becomes accentuated that some form of co-operation in which the workers would be directly interested in keeping the wheels of industry moving would confer untold benefits upon all concerned. The tendency being for all productive operations to be carried out on a stupendous scale, there is no opportunity left for small capital to engage in manufacture unless it be done by co-operation or by the purchase of stock in companies. Co-operation is the proper manner for workmen to secure interests in production business, but there seems to be very little tendency, more's the pity, toward that form of self-help among the people who take the lead in organizing the nation's workmen. So far the work of these leaders has been principally to cultivate antagonism between capital and labor with disastrous results to both sides.

A certain class of social economists are constantly prating about the interest of capital and labor being identical. The only identical interest is that the one cannot produce without the other, but in other respects it is to the interest of each to get all he can out of the other. That is the way the case works in practical life. If anything could be done to curtail this grasping spirit it would greatly enhance the comfort of millions of people.

Several attempts have been made of late by capitalists to invite labor to sail in the same boat as their employers, but no great success has been achieved. One of the most ambitious of these schemes was made about a year ago by the United States Steel Corporation inviting its employees to become stockholders in the company and offering them inducements which seemed highly advantageous. Special incentives were offered to those who "are charged with the responsibility of managing and operating these vast companies." The stock was offered at $82.50 a share, when during the same week the offer was made it sold in the market as high as $87 a share. Quite a number of the employees of the company availed themselves of this offer and purchased the water laden stock which shortly afterward displayed a decided tendency to drop toward its natural level and it went down to about $60 a share.

United States Steel Stock became badly discredited and it looked as if the enterprising employees who bought of the stock were likely to lose a large share of their investment. At this juncture the finance committee of the corporation stepped in and guaranteed the value of the stock to their employee purchasers. This was a wise and sagacious action. "All's well that ends well," may remark those stockholders, but to us it carries the lesson for workmen of all kinds, "don't invest in your employer's stock or in any other."

There are some railroad companies that have urged their employees to invest their savings in the stock of the company, but it is unwise policy. Very few railroad presidents or the president of any other corporation have assurance that the stock they represent will not soon fall into other hands or even into the hands of Wall street gamblers, who may manipulate it with as little consideration for small holders as if it were merely poker chips. If a railroad magnate wishes to have the employees financially interested in the property he ought to make some arrangement by which they could purchase bonds even if it were done by instalments. Bonds are as safe as mortgages and their value is little influenced by market gambling. Those who are holders of stock would be very wise to convert their shares into bonds as soon as convenient. The indications are that railroad stocks will follow the industrials in the near future and be worth less money than they are to-day.

Inevitable and Preventable Heat Losses.

One of the first discoveries usually made by students of steam engineering, is the fact that in transforming the latent energy of coal into mechanical work, the steam engine is an extremely wasteful machine. Scientists have found that a pound of good coal represents about eleven millions of foot pounds of energy. Very few steam engines develop one million foot pounds of work for each pound of coal used in the furnace, and engines utilizing 10 per cent. of the coal energy are considered thoroughly first class. This percentage of waste appears enormous and the novice readily concludes that mismanagement must be responsible for a great portion of the wasted power. But increase of knowledge brings a realizing sense of the tremendous difficulties that obstruct the way of radically increasing the efficiency of the steam engine.

There have been a great many prime motors invented for the purpose of converting the latent energy of carbon into mechanical work and several of them have been capable of utilizing a greater proportion than the steam engine of the heat energy employed; but with the exception of the high class of gas engines none have been so reliable for everyday work, and, with all its shortcomings and defects, the steam engine continues to be popular with the greater part of power users who find it important that their machinery be kept running day by day without interruption. In popular addresses we are continually hearing the prediction reiterated that science will yet lead the way in effecting radical improvements upon the steam engine. The past achievements of science in this direction have been exceedingly slender, and do not make the promises of future deeds very encouraging. The practical men, on the other hand, have done most toward developing and perfecting the steam engine, and those whose opinions regarding future progress are entitled to the highest consideration, believe that its limit of possible economy has been practically reached.

Although a steam engine that converts 10 per cent. of the potential energy of fuel into mechanical work may be regarded as a wasteful machine, it is not wasteful when compared with the great mass of engines running on railroad trains and our mills, for very few of these utilize more than 5 per cent. of the energy stored in the coal used. The opportunity for railroad engine improvers at the present day appears to be in carrying out methods which will bring up the performance of the common five per cent. engine toward the high-class engine that takes ten per cent. dividend out of the coal. The men who busy themselves with this problem may safely leave to others the work of improving what is now regarded as the high-class engine. The great avenue of waste with all steam engines is the exhaust steam, and there is little probability that the loss of heat passing out of this channel will ever be radically decreased while steam is employed as a mode of motion.

There are, however, lines of economy that may be worked on to advantage by the users and designers of locomotives. Numerous minor channels of waste could be closed up by intelligent management, and the result in saving would materially increase the economy of the engine. Even the most defective locomotive boilers in use are more efficient in giving back equivalents for the heat received, than the best proportioned and best protected cylinders; but it is easier effecting improvements on the boiler than on the cylinders. A good locomotive boiler accounts for over 50 per cent. of the heat liberated from the coal; few cylinders cover 10 per cent. of the steam entering them into mechanical work. Still, with all of its relative efficiency, there is much preventa-

ble waste going on in boilers owing to faults of design and to unskillful and careless management. There is loss from bad proportion of grate area and flue surface, from the gases of combustion being improperly mixed, from defective means of admitting and restraining air supply, from the gases being passed over the heating surfaces too rapidly, from bad boiler circulation, from water being passed through the dry pipe along with the steam and from radiation of heat due to defective covering. The preventable losses in the cylinders are due to too limited expansion caused in various ways, to back pressure caused by faults of design and restricted exhaust opening, to attenuated steam line at short cut-off, and excessive compression resulting also from faulty design of the valve motion, and to condensation caused by entrained wet steam and imperfect covering. In spite of the high steam pressure now so common, very wet steam finds its way into most cylinders, causing most wasteful condensation that could be greatly reduced by a steam superheater. It seems to us that some of the super-heaters now on trial would effect greater economy in the use of steam than any improvement recently tried.

Pointing out errors of design and causes of waste is, we admit, much easier than the work of effecting remedies. Wasteful practices and carelessness about details are apt to creep into the best conducted departments unless persistently checked by supervising officials. The vigilance and labor that produce the checks must be ever awake, ever active, and when this is the case their effects are very apparent on the operating expenses.

Books Reviewed.

How to Measure Up Woodwork for Buildings, by Owen B. Magnus. Publishers, the Industrial Publication Company, New York, 1903. Price, 50 cents.

This book of 79 pages, 5x7 ins., with 161 illustrations, is intended to aid the estimator or mechanic in the measuring up of woodwork for buildings from plans or in the building itself. It gives full and explicit directions for doing this work, either where the building is entirely composed of wood, or where the measuring of the trim alone has to be done, as in brick or stone buildings. The concluding chapter gives some miscellaneous information such as the weight of moulding, weight of lumber, weight of windows, weight of doors, amount of nails required in carpenter work, etc., etc.

The Hardwood Finisher. Compiled and edited by F. T. Hodgson. Second edition. Publishers, The Industrial Publication Company, New York, 1903. Price, $1.00.

This book has 109 pages which are about 7x5 ins. It contains directions for finishing in natural colors and in antique, mahogany, cherry, oak, sycamore, birch, walnut, redwood, ash, pine and other domestic woods. It gives rules for filling, staining, varnishing, polishing, dyeing, gilding and bronzing. In this, the second edition, there has been added an illustrated treatise on the preparation of wood work by the joiner or cabinet maker for the finisher. The book is divided into four chapters: Hardwood finishing, preparing wood work for the finisher, wood fillers and wood filling; staining, finishing, varnishing and polishing. The chapters are also divided into paragraphs with opening words giving the subject of the paragraph printed in large type, and these paragraphs are all indexed at the end of the book.

The Mechanical Engineer's Pocket Book, by the late D. Kinnear Clark. Revised by Mr. H. H. P. Powels. Publishers, D. Van Nostrand Company, New York. 1903. Price, $3.00.

The fifth edition of this valuable mechanical engineer's pocketbook comes from the press revised throughout and enlarged. The book is too well known in engineering circles to require an extensive review. The copy before us, however, contains, with the index, 692 pages. It is neatly bound in red morocco and the pages are about 6x3¾ ins. and just about 1 in. thick. The edges of the pages are gilt and have rounded corners. It is a handy book of reference for daily use in engineering practice and contains all manner of tables, formulas, rules and general engineering data.

There is something curious about the way that the people who regulate the spelling of words make decisions. According to common sense the words kerosene and gasolene ought to have the last syllable spelled with i instead of e, or with two e's instead of one. We wonder if the pronunciation will change to agree with the spelling, or if the spelling will be adjusted to suit the pronunciation. We notice that our British friends spell the words as they are pronounced.

Before the articles on "The Growth of the Locomotive," by Angus Sinclair, are published in book form the author wishes to obtain representative locomotives built during the decades 1850, 1860 and 1870. Those of 1850 and 1860 are scarce. If any reader will favor us with the loan of the picture of a locomotive built during these decades the favor will be appreciated.

The edition of Blackall's Air-Brake Catechism, which we have been selling for $1.50, is exhausted and the new and enlarged edition now for sale costs $2.00. Please remember this.

QUESTIONS ANSWERED.

(68) F. B. H., Philadelphia, writes:

What would be the result if, by mistake, the main driving wheels of an engine should be turned end for end and the eccentrics being keyed could not be shifted? I think the engine would move, but B. says not. A.—You are right, but with the lever in forward motion the engine would run backward, if it was an indirect motion engine, which, we presume, is what you had in mind.

(69) A. D. P., Toronto, asks:

Can an engine with both eccentrics broken on left side and the back up on right side be put into condition to help herself to terminal, light, without assistance? A.—Yes; you have the same condition here that exists in stationary engines with one eccentric whose motion is in one direction. Your lever would have to remain in the corner of quadrant to avoid damage to link and valve gear, and your engine would be a poor steamer.

(70) R. O. H., Mason City, Ia., writes:

I was assisting an old valve setter while running over the valves of an old engine which had a lot of lost motion. When the valve stem was traveling forward he took hold of it and kept shoving it in the same direction to take out the lost motion. I think he should have shoved it the other way, for, in doing as he did, a considerable amount of lead was obtained, which he claims an old engine will get, while I say an old engine will lose lead. Which is right? A.—An old engine will lose lead, as lost motion develops; you are right in that; but the valve setter was right in the way he took the lost motion out. He placed the valve as nearly as possible where it stood before the lost motion developed, and if he took all the lost motion out of the valve gear he would give back the lost lead. If he did not intend to take the lost motion out, he would have to move the eccentric to regain the lost lead.

(71) T. C. S., Durand, Mich., writes:

(1) Suppose you have a Standard type engine, overhung springs, with a broken equalizer post, on passenger train; what is the quickest way to handle this breakdown, and what is a fair estimate of time required for same? A.—About the only thing you can do if the post itself is broken is to block the boxes, which you can do easily by running the wheels up on wooden wedges placed on the track. It is impossible to give you a close estimate of the time required, because no two men take exactly the same time to do a given piece of work, and, besides, the operation involved may be complicated by other things.. If the breakage of the equalizing post occurred on the right side, the reach rod might become jambed, in which case you would have to disconnect the

reach rod from the tumbling shaft arm, before you could move up on the wooden wedge.

(2) With a Detroit, No. 3 C, lubricator, also Michigan lubricator choke plugs at steam chest plug, with lubricator in operation and engine working steam, is the oil pipe from steam chest to lubricator at this time filled with steam or is it filled with water, and in either case what influence would a bend or pocket in the oil pipe have? A.—The pipe from steam chest to lubricator will be filled with steam and oil, some condensation will take place in pipe between where it leaves the boiler jacket and reaches the steam chest, a bend or pocket in the pipe will have little or no effect as the current in the pipe is flowing toward the steam chest.

(72) C. P. C., St. Louis, writes:

I was greatly interested in your answer to Question 61, of the September issue, on the expansion and contraction of air under compression. Kindly answer the following: We pump up a reservoir of eight cubic feet to 75 lbs. gauge pressure. The temperature of the air in the reservoir at the time the pump is stopped is 110° Fahrenheit. The temperature of the reservoir and contained air is permitted to fall to the surrounding atmospheric temperature of 60° F. What loss in gauge pressure have we suffered; there being absolutely no leakage? A.—You would probably, in such a case, lose between 6 and 7 lbs. gauge pressure. In answering this question we have assumed that the temperatures you give are correct, though we think air at 60° F. compressed to 75 lbs. gauge pressure would be hotter than 110°. This kind of an experiment is very difficult to perform, because it is practically impossible to retain all the heat due to compression, in the air during the operation, and it is equally impossible to abstract all the extra heat as the pressure rises. The outside of the containing vessel might be cooled to the required temperature while the air near the center of the drum remained hot. Good air compressor practice gives a sort of happy mean between the theoretical curves due to what is called *adiabatic* and to *isothermal* compression. The first of these words indicates that the heat of compression does not pass away, and the second indicates that it does pass away as the compression proceeds. Air heated expands 1/273 of its volume for every degree of temperature (Centigrade) which it receives. The equivalent of this fraction for the Fahrenheit thermometer is 1/490. If you care to follow up the subject further the book on compressed air by Frank Richards is useful.

We lose money and comfort, and even temper sometimes, by not learning to be more careful.—*David Copperfield.*

Break-Downs.

BY JOSEPH A. BAKER

The object of this chapter is to give the easiest and quickest way of making temporary repairs to a disabled locomotive with the few tools supplied and at the engineman's command.

Some of the instructions given a decade ago are fast becoming obsolete, as the frequent and fast trains on our trunk lines of to-day demand the clearing of the main line with as little delay as possible to prevent a blockade. With this object in view the writer who until a few years ago was in the harness himself for 20-odd years, will endeavor to present the subject of break-downs as plainly as possible, so as to make it possible for the man of ordinary education to understand.

In order not to confuse, let it be understood that a locomotive consists of two complete and independent engines, so that in case of disablement of one the other can still perform its work. Much valuable time can be saved in knowing how and just what parts to disconnect in certain break-downs, and this is where the up-to-date engineman shows his value to his employer. A good engineman will carefully inspect his engine before starting on a trip, whether pooled or regularly assigned, to avoid accidents of this nature. With the heavy power of to-day some of the temporary repairs insisted upon in former years are abandoned to-day, and many of the tools furnished engines formerly are removed from them now.

1. DISCONNECTING ONE SIDE.

Aim to do as little and as quickly consistent with safety. Never remove a main rod unless absolutely necessary. Pinch-bars are of very little use to move the large engines of to-day and a main rod left up will, with a little thought, supplant the pinch-bar and do it more effectively. In removing the forward section of side rods on some makes of ten-wheel, mogul or consolidations, care must be exercised where blocking of cross-head back is necessary. Very often the crank pin will interfere with the piston rod key in cross-head. When this is the case cut off the key flush with the cross-head or block the cross-head forward.

2. BROKEN MAIN ROD.

Remove the broken parts, block cross-head back to within one-half inch of clearance to keep the cylinder packing out of the counterbore, disconnect cylinder cock rod on disabled side and block cocks open. Shift valve in the same direction as piston if a slide valve or outside admission piston valve, and in the opposite direction if an inside admission piston valve. An easy way to remember and distinguish a direct from an indirect motion is in the position of [illegible] rocker box, with the direct both arms are either above or below the rocker [illegible] opening to show steam at the cylinder cock which will take the presssure off [illegible]

3. BROKEN SIDE ROD.

Remove the broken rod and the same section opposite. If the break is on the forward section of a ten-wheeler or mogul and the knuckle-pin on the rear section, take down all side rods. If the break is on the knuckle-pin section, take down only those sections. If the intermediate section on a consolidation, take down all sections, if on a forward or back section take down only those sections.

4. BROKEN [illegible]

This is not so hard to locate as one imagines. Generally the engineer in attempting to locate the heavy blow places the engine on the good side on the dead center unintentionally, and is then unable to move her either forward or back. First inspect your eccentrics and blades, and if found intact go to the side on the quarter. A little thought will tell you that if this side were not disabled it would move the engine off the center on the other side. If your chest has a release valve, don't take up the cover. Disconnect the valve stem and take out release valve. You can then shift the valve to cover steam ports and also help your good side off the dead center. When covering ports, insert a plug in the release valve of sufficient length to hold the valve central from one end and with the valve-rod from the other. Don't take down main rod, you may want it to help you off the center again. Block cylinder cocks open on that side and with a very little admission of steam through valve the cylinder will get sufficient oil to prevent damage. The Vandalia Railway has a record of a passenger engine making 86 miles this way and no damage to cylinder.

5. BROKEN PISTON ROD.

If the broken rod has taken cylinder head along with it, disconnect valve-rod only and cover ports. Take in as much of a train as you can.

6. BROKEN PISTON OR VALVE GLAND.

If this break happens near the stud, place a large washer on either side of the lug over the stud and tighten nuts against them. With a broken valve gland, use the clamp generally provided to hold a disconnected valve central, and bend the beak out of the way to clear the valve-rod key. Where stud has pulled out, changing end for end sometimes will answer. You can generally find a nut around your engine that will answer for this purpose. Sometimes a

little canvas wrapped around the gland and forced into the stuffing box will hold.

7. BROKEN CYLINDER HEAD.

In most instances there is a heavy leakage of steam around the head to give warning, and if it is a forward head it may be saved from total destruction. The writer on several occasions of this kind placed heavy blocking against the head and with a screw jack placed against the pilot timber, brought in his train a distance of 100 miles without any further mishap. With the back head broken in such a manner as not to interfere with the guide block it is generally safe to run with the main rod up, but if there is any liability to damage, take down rod and cover steam ports.

8. BROKEN STEAM CHEST OR COVER.

When the break is not a bad one, wedging between the chest and bolts is sometimes successful, but where the break is a bad one, remove the cover, block the supply ports, which on modern engines are at each end of cylinder, with blocking of sufficient thickness to be held down by cover, disconnect valve stem only, block the cylinder cocks open, and proceed on one side. The same method applies to a broken cover.

9. BROKEN RELEASE VALVE.

This does not imply that the valve is entirely useless. Remove release valve casing from chest and insert a wooden plug in casing and screw back in. Better still, if you have a spare washout plug on your engine, remove the casing and screw the plug in instead. A modern engine should be supplied with such emergency appliances and a modern engineer will provide himself with such appliances.

10. BROKEN CRANK-PIN.

With a broken main crank-pin, any class of engine, take down all side rods and be sure that the crank-pin on the forward wheel does not interfere with the cross-head in blocking the latter. With the back crank-pin on a consolidation or a ten-wheel engine, proceed as with a broken side rod, see chapter on side-rods, but if the crank-pin of an intermediate, otherwise known as driver No. 2, take down all side-rods and run in light with main rods up. Remember that taking down one section and not the other on the opposite side is dangerous; there is nothing to pull the wheel on the good side off the dead center. In only one case is this permissible when the eccentrics are on the first or leading, and the main rod on the second or main drivers. In this instance if the forward section with a solid end breaks, the other side is left up so as to control the valve motion on the good side, but the valve gear on the crippled side must be disconnected.

11. BROKEN CROSS-HEAD.

If the break is with a 4-bar guide or a Laird guide with yoke, block ahead and let main rod rest in yoke; but the butt end brass and strap must come down, otherwise the rod would interfere with main pin. If the cross-head is of the alligator type and yoke secured near middle of guide, block back and take down main rod. It is always a good plan to allow enough port opening in blocking valves central, to admit a little steam against the piston in the direction you are blocking. Remember also that an outside admission valve is pushed in the same direction as the piston and an inside admission in the opposite direction.

12. BROKEN ECCENTRICS, STRAPS AND BLADES.

With a broken go-ahead eccentric or blade take down the back-up also. If the back-up is not disturbed the link lifter must be taken down. With a broken back-up eccentric, strap or blade, the go-ahead need not come down, but the engine must be run with a full cut-off and no attempt made to bring the lever back to center of quadrant. The above suggestions are only to be used where the distance to a siding is short and you want to clear the main line. At any other time if you break one, take down the other also and cover steam ports. Don't take down main rod.

13. BROKEN GUIDE YOKE.

If a bad break, take down main rod, disconnect valve-stem and cover ports.

14. BROKEN ROCKER-BOX OR ARM.

With the bottom rocker arm broken there is more or less danger of catching the link or blade on the rocker-box if the link motion is considerably worn. Take no chances but take down both eccentric straps and blades and cover ports. If the top arm is broken, remove broken part and cover ports.

With a direct motion valve gear remove transmitting bar and broken arm and cover ports. By transmitting bar is meant the rod that conveys the motion from the link to the rocker arm. For a broken rocker-box or sheared bolts, if no repairs are possible or no bolts at hand of nearly the same diameter as the old ones, take down both eccentric straps and secure the link to link lifter and remove rocker-box if bolts are sheared.

15. BROKEN LINK LIFTER.

Place the lever in quadrant at a point where you can comfortably start your train. Cut a block of wood to fit between the top of link block and link, also one to fit between bottom of link block and link. Fasten them securely. Blocking for the forward motion, never drop the lever below the point of cut-off selected, as the lifting arm on tumbling shaft may interfere with link. You can cut the lever back toward the center without danger and work steam expansively on the good side, but this will give you two light and two heavy exhausts. Don't attempt to reverse your engine without first removing the blocking from below the link block and placing it on the top of the link block.

Gifts to Cornell University.

The president of Cornell University announced recently that the Department of Railway Engineering of Sibley College had received two substantial gifts of money for the erection of a laboratory for that department. Mr. H. H. Vreeland, president of the Interurban Street Railway Company of New York, starts the fund with $1,000, and Mr. M. N. Forney, of New York, the well-known consulting railway engineer, has also promised a large gift. He expressed a desire to equal Mr. Vreeland's contribution.

The plans drawn for a new hall of experimental engineering, to be built in the rear of Sibley College, provide for a locomotive laboratory adjoining the present blacksmith's shop. The building will cost between $10,000 and $15,000. The Baldwin Locomotive Works has already presented a complete locomotive especially made for experimental work and valued at $20,000, to be available as soon as the laboratory is built. Contributions from several other men of means are assured.

"The Canadian Pacific carries off the honors for strange names among its officials. Mr. Ham is the road's advertising manager, with headquarters at Montreal, and the city ticket office there is in charge of Mr. Egg. Because of their strange names, the two men became fast friends, and if they chance to be out of town, as they sometimes do, they both report to Mr. Bacon, whose chief clerk is Brown. A few days ago Ham called on Egg at the latter's office. While talking, the telephone rang. He was asked if that was the Canadian Pacific office. Before he answered as to that, he said, 'Who do you want, Ham or Egg?' 'Neither,' was the reply. 'I want the Canadian Pacific ticket office. I don't want any of your old ham or eggs. Central, get that cheap restaurant off this wire.' Both Ham and Egg are now looking for that man."—*Railway and Shipping World.*

The editions of Conger's Air Brake Cathechism that were sold for 75 cents are all exhausted and an enlarged book will be offered in place of the old one. The new catechism will cost one dollar. The new edition is so much of an improvement over the old one that the small rise of price will cause no complaint.

Air-Brake Department.

CONDUCTED BY F. M. NELLIS.

Air Pump Repairs.

It has been observed that considerable trouble is now being had with air pumps on trains going into high-speed brake service. The trouble seems to be that sufficient care has not been given to properly repairing the air pump and putting the air cylinder in proper condition.

When only the 70 pounds train line pressure and 90 pounds main reservoir pressure were required, the pumps were amply able to reach these figures, but when the pressures have been raised to 110 pounds train line and 130 pounds main reservoir line, the pump is unable to reach the higher pressures. The lower pressures the air pump can easily reach with the piston packing of the air cylinder in fair condition, but when a considerably higher pressure is demanded, this condition of air cylinder packing, which is sufficient for the low pressure, is not sufficient for the high pressures, and therefore fails. Most any pump can compress air to 50, 60 or 70 pounds pressure, but each succeeding 10 pounds up to 150 is proportionately more difficult to compress. The whole matter summed up is that the test of the air pump after apparently good repairs have been made, has been sufficiently good to pass pumps for low pressures, but it is not sufficiently good for higher pressures.

A new test for higher pressures will necessarily have to be made, after the pump has been repaired, and that means that better repairs will have to be made. The old repairs were good enough for the low pressures, but better repairs will have to be made for the high pressures of to-day. This means that not only must the packing rings in the piston be renewed, but the cylinder must be rebored, too. Also, the rings must be fitted new into the piston head grooves. Air pressure will leak past the sides of a ring that is poorly fitted to the sides of the groove as badly as it will past the outside diameter of the ring and the cylinder wall. A new ring fitted to an old cylinder only fits at mid-stroke position, and is loose at the ends of the stroke, where the greatest leakage past the piston occurs and where more air pressure is lost.

The repairs on the air end of the pump must be better made for high speed brake service than is now being done for 70 pounds train line pressure. This means that packing rings must be renewed oftener and cylinders rebored more frequently.

The Air Brake Inspector.

As modern railroading progresses, and longer trains are being hauled by more powerful locomotives, the position of general air brake inspector on railroads becomes more important and of greater consideration.

The main object sought in appointing a general air brake inspector is to achieve the highest possible efficiency in air brake service. This efficiency will depend very largely on the methods employed by the inspector and the directions in which his energies are exerted to accomplish the desired results. It has been the prevailing custom to use a car, or local school plant, to instruct the men in the various devices, the belief being that the more a man knew about the structural parts of the apparatus, the better would be his road service. Later, it has been the belief that the instruction should be confined alone to school rooms, but should be extended to cover actual operative service on the road as well. In accordance with this belief a number of roads have made secondary the inspector's work in the instruction car and placed him on the road, installing air brake testing plants in the various terminal yards, and riding with the men. The instructor's efforts, therefore, have been directed more to the maintenance of the brakes and to their operation on the road. Results prove quite conclusively that this course is a good one; for no crew can handle a long train smoothly if the train pipes leak badly and "kickers" get into the train. The most skilled workman does not perform a creditable job if he be supplied with poor tools.

A prominent inspector recently made remark that the preliminary training of a man in air brake practice should be had in the car, but that such training should be dropped in due season and advance instruction be given him in actual practice on the road, keeping in mind, meanwhile, the important fact that to do good work the air brakes must be creditably maintained.

Graduated Release and Retaining Triple Valves.

It seems that any one who nowadays wishes to invent a new triple valve turns his attention to either the graduated release triple valve or a triple valve containing a feature which retains the brake cylinder pressure without the assistance of a retaining valve. In the first place, it is open to question whether such a modified triple valve is necessary, or even desirable for general service. It has been very properly argued that a triple valve which would graduate its release in the same manner that it graduates its applications, would be a desirable triple valve for an electric railway service, and similar service of this character. Upon second thought, however, it would seem doubtful whether this is true.

Attention has been called to the fact that some kind of triple valve that would closely approach either the straight air brake or vacuum brake in its operation, would be better for electric railroad service than the standard quick-action triple valve, inasmuch that the braking power could be quickly varied by slightly increasing or simply diminishing the brake cylinder pressure as the requirements of the stop and the engineer's judgment would dictate. This is further argued to doubtful advantage when it is said that smoother stops can be obtained with such a device than with a standard quick-action automatic brake. While it is true that some very smooth stops are possible with either the straight air brake or the vacuum brake, still it is possible to so abuse their operation that equally rough stops may be had with them as with the standard automatic brake improperly handled. The straight air brake and vacuum brake are seldom, if ever, operated ideally, so that the brake power is greatest at the beginning of the stop and eased off as the stop approaches its finish. This is noticeably true when we remember that with the vacuum brake several light applications are made to each stop. The first application is manifested by an escape of steam at the ejector exhaust, and then shut off. Several similar discharges of steam can be noticed, and indicates that the brake is being applied harder and harder. Observation of the engineer's action in the cab will show that he very seldom, if ever, releases a part of the brake power obtained. He will begin with a light application at the start, continuing with additional applications to the finish, the braking power growing heavier as the speed of the train reduces. This same applies to the straight air brake. It can also be truthfully said that this method of braking is entirely wrong, and diametrically opposite to the proper method.

The correct and most advantageous way is to apply the brake fully at the beginning of the stop, when the speed

of the train is highest, and have the braking power reduce as the speed of the train reduces. This is an ideal way of braking, and is embraced in an emergency application of the Westinghouse high-speed brake. It would seem that the nearest approach to this kind of an ideal application could be had by the ordinary quick-action automatic triple valve, so modified that the full emergency application at the start of the stop could be released, and the exhaust port of the triple valve so reduced or modified as to permit pressure to escape slowly as the speed of the train came down. If it became necessary to shut off the exhaust and hold the braking power a little longer, it could be done by making a light reapplication of the brake.

CORRESPONDENCE.

Release Cock in Auxiliary Reservoir or Brake Cylinder.

I am much interested in a few remarks, which in your September issue of Railway and Locomotive Engineering, you make to a correspondent, P. E. M., Murray Bridge, So. Australia. Like him I have heard many, in this country at any rate, who would prefer the release valves in their old position, viz., on the brake cylinder, for the reason that in their present position these cocks, unless they are carefully worked, are apt to cause delay.

Suppose, for instance, a train arrives and stops at a station on a slightly falling gradient, with the brakes applied, and say three vehicles have to be run off it into a siding. The engine is uncoupled and moves away from the train and the shunter proceeds to release the brakes on the three vehicles. Number one brake is easily bled off. He next goes to number two, and after giving it a good sniff, proceeds to the third vehicle, which he in turn releases only to find that unless he has been careful in reducing the pressure in the auxiliary reservoirs, that the brakes on numbers one and two are again set. In busy stations where there is much hurry and noise from engines, etc., it is difficult at times to tell when the triples reverse themselves, and so to stop pulling the release cock. Thus I have heard many say that they would rather have the old arrangement as being more certain, if, perhaps, a little longer in its action.

A case came under my notice the other day. I failed to release the brakes on two vehicles by opening the release cocks on the auxiliary reservoirs, and the only reason I can think of to account for it is that the pressure in the train pipe had all or nearly all gone. The triples were new, and of the quick action pattern, but working as ordinary triples by means of the cock usual on British railways. In this instance had the release cocks been on the brake cylinders I would have experienced no difficulty.

Henry Walker.

Barrow in England.

[In the instance cited, the better practice would have been to hold the three cars with hand brakes after the stop had been made and brakes released. If, however, that method is seriously inconvenient, cautious handling of the release cock must be resorted to, care being taken to make short, sharp discharges of pressure at the release cock until the exhaust is hard at the triple valve, or the brake cylinder piston is seen to move inward. In the last case, all air, of course, would have to be bled from the auxiliary reservoir.—Ed.]

Undue Release of Brakes.

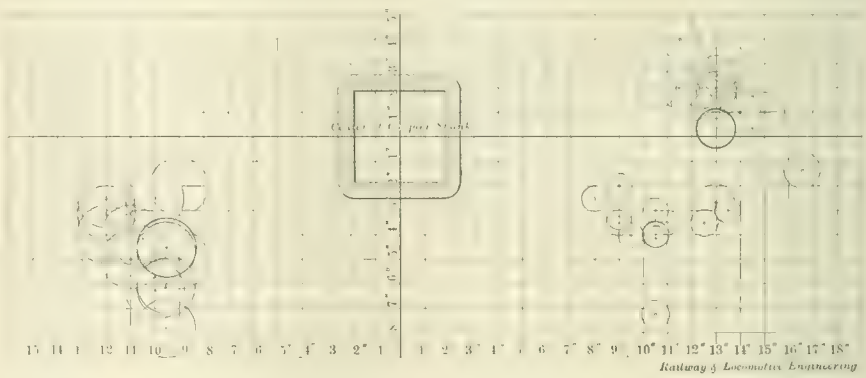
In answer to the question No. 46 in your isue of June regarding brakes coming off after a 2 pounds reduction, though the 7 pounds reduction held the brakes set on the first application, and rotary valve on lap. I ask any of the enginemen on your side of the world to give it a trial, as it is not any one engine you get the results from over here, but any engine you like to try. If what I say is true, your answer to the question can't be right, as all equalization pistons can't be dirty, or have foreign matter causing the piston to close the port, or rotary valves leaking.

And if you make another 2 pounds reduction, after the first 2 pounds, more brakes will come off and others that were off will go on. If brakes come off with these light reductions on fairly long trains when standing, what must it be when braking into a station and a nasty jar is felt through the train? Sometimes the train parts couplings, caused no doubt by triple valves going into release position, charging up those auxiliaries that have released their brakes, and setting the other brakes harder by the reduction that has taken place in the train pipe by the auxiliaries recharging.

It makes an engineman look foolish when working a heavy train, to come up with a rush after making an application, and the blame to be put on him, when it is not his fault, but the fault of some of the triples going into release position when they ought not to have done so. J. Hopkins.

Wellington Station, New Zealand.

[We assume that the equalizing discharge form of brake valve has been used, and that the reductions have been made in service position. In this event, the answer given to question 46 is applicable. If, however, the service position has been passed and emergency position used, even slightly, and air drawn direct from the train pipe instead of through the medium of the equalizing piston, the current of air rushing forward, set up in the train pipe by using the emergency position even slightly, will tend to release brakes, favoring these on the forward end of the train. A service application, with the equalizing piston working so stiffly as to suddenly close the train pipe exhaust at the brake valve, sets up a similar surge forward with the same tendency to release forward brakes. After observing and possibly correcting the above referred to irregularities, the condition of the triple valves should be looked into. Possibly insufficient attention is given to cleaning and oiling. Triples working stiffly, or having dirt between the graduating valve and seat and slide valve seat in poor condition would allow triples to whistle off on a light reduction.—Ed.]



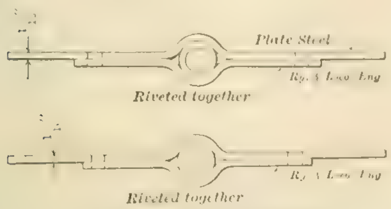
POSITION OF THE STEAM HEAT, AIR-BRAKE AND SIGNAL PIPE CONNECTIONS AS INDICATED BY REPLIES TO A LETTER SENT OUT BY THE M.C.B. ASS'N ASKING RAILROADS FOR THESE LOCATIONS.

Mr. Thomas Renaud has been appointer air-brake instructor for the Wiggins Ferry Co., which company embraces the East St. Louis Connecting Railway and St. Louis Transfer Railway, headquarters being at St. Louis, Mo.

The 1903 Air Brake proceedings tell of frozen train pipes. Send to us for a copy.

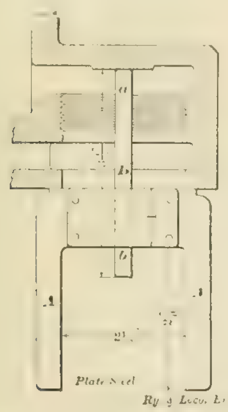
A Clever Design of Gauge.

These gauges, which I claim to have originated, and are illustrated herewith, are two in number, and are used in correcting the air valve lift in 9½ in. and 11 in. Westinghouse air pumps. In the 11 in. pump it may be necessary to change the dimensions of the gauge somewhat, but so long as the staff, B, of the gauge is the required lift of air valve longer than the width of the gauge, A, this does not matter.



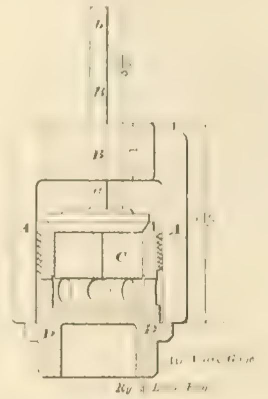
TOP VIEW OF GAUGES.

The gauge can be made in a variety of ways. I have illustrated the form which seemed to be the most simple to make. As indicated by the drawings, the gauge is made of two plates of steel, A, riveted together so as to bring a pressure on the staff, B, and prevent it from being moved by accident.

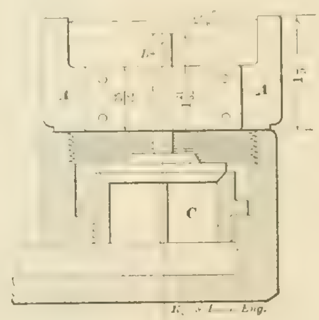

ADJUSTING THE GAUGE IN THE CAGE CAVITY.

The larger of the two gauges is used in regulating the lift of lower receiving or discharge valve, and is described as follows: The air valve cage, D, is removed from the cylinder of the pump. he gauge is inserted in the cavity from which the cage was removed, as shown in the drawing, and the staff of the gauge pressed firmly against the valve stop, bringing the body of the gauge at the same time against the bottom face of the cylinder. The gauge is then removed and placed on the air valve cage with the valve in position. the valve filed off until the points of the gauge resting on the flange of cage will permit the head of the valve to just touch the staff of the gauge, as shown in the drawing. It will be found that the valve has the required lift, 3-32 of an inch. Thus it will be seen that the use of this gauge does away with all measuring in adjusting the lift of the air valves.

The smaller gauge is used in regulating the lift of the upper receiving or discharge valves, and the same principle is involved in this gauge as in the other,

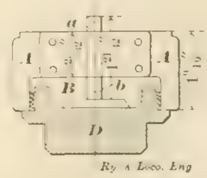

GAUGE REVERSED, GETTING LIFT OF VALVE.

and it is used in a similar manner. The chamber cap is removed, the gauge placed on the cap, as shown in the drawing, pressing the staff firmly down on the valve stop. The gauge is then removed, placed on the cylinder as shown in the drawing, filing away the valve until the head just touches the staff of


ADJUSTING LIFT OF VALVE.

the gauge while the gauge is held firmly against the face of the cylinder. Care should be taken that the gauge is not shifted after adjusting to chamber cap.

The small projection which is usually found worn out on the valve stop should be removed. The interference of this


ADJUSTING THE GAUGE.

projection is overcome in adjusting the gauge, however, by having the end of the staff hollowed out as shown.

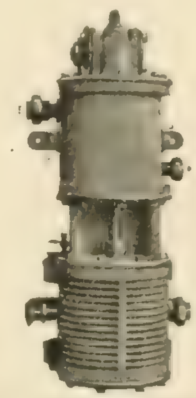
This gauge does away with rule or scale measuring and the possible errors of such method. We have used the gauge for some time past, and have had excellent results.

M. H. [illegible]
Foreman Air Pump Reprs.,
N. Y. C. & H. R. R. R.
West Albany, N. Y.

A Queer Acting 9 1-2 Inch Air Pump.

I have had an odd experience with a queer acting 9½ inch air pump, which I give herewith for the benefit of someone else who may possibly be caught as I was.

A short time ago it was decided by our officials to instal a battery of three 9½ inch air pumps to supply air for testing repaired air-brake apparatus in the shop and for testing air brakes on freight cars on the repair track. These 9½ inch pumps were taken from the storeroom and erected in the boiler room, all three pumps being placed side by side, and


QUEER ACTING 9½ INCH PUMP

taking live steam from a 3 inch main steam pipe.

The exhausts of the three pumps were connected with a 4-inch exhaust pipe. A throttle cock was placed in the steam pipe of each pump, and stop cocks were placed in discharge pipe leading from each pump. When the steam was turned on, No. 1 and No. 2 pumps started off in a business like manner, but pump No. 3 made an up-stroke and finished as though wedging against something and could not be induced to make any further movement. The steam was turned off by closing the throttle cock and the steam pipe disconnected at the pump, but the stop cock in the exhaust pipe was left open. Pump No. 3 then made a complete stroke, very much to our surprise, and continued to run very slowly, but regularly.

Cutting a long story short, pump No. 3 was a left-hand side pump, and we had it connected up wrong and was running with exhaust steam. By referring to the opposite cut you well understand our trouble. The exhaust pipe was connected at A and live steam pipe at B, the plugs C and D being left in. We exchanged the plugs and connections,

putting connection B where plug C is shown and connection A where plug D is shown, thus converting our left hand 9½ inch pump to a right hand pump.

AMOS JUDD.

Boston, Mass.

Testing Air Cylinders of the New York Duplex Pump.

There is now hardly any time or place on a large road where air pumps are not required to do about all they are capable of doing to supply air at ordinary pressure for the long trains hauled on levels, and at much higher pressure for the shorter ones handled on heavy grades, and, in addition to supply air for the numerous compressed air attachments to be found upon the locomotive, and on passenger cars, in the form of bell ringers, air sanders, water raising systems, etc., as well as to supply the all too numerous leaks to be found in the train pipe and its connections.

For this reason the condition of an air pump, especially the air end, should be looked after carefully, and this end should be frequently tested to ascertain its condition, and if any parts are found defective, to have necessary repairs made.

For those who use the duplex air pump, the following information will be found helpful in locating defective air valves, packing rings, etc.

Referring to the cut of the duplex pump, valves 9 and 10 are the air inlet valves for the low pressure, or larger, air cylinder 4. If these valves leak, they will allow the air that is being compressed ahead of piston 32 to blow back to the atmosphere. Hence, whenever piston 32 is moving toward either of these valves and air is felt escaping to the atmosphere from the one toward which the piston is moving, it is an indication that that valve is leaking, and that it should receive attention. It may be noticed, too, that the piston will make a quicker stroke toward the leaky air inlet valve than toward the other that is tight.

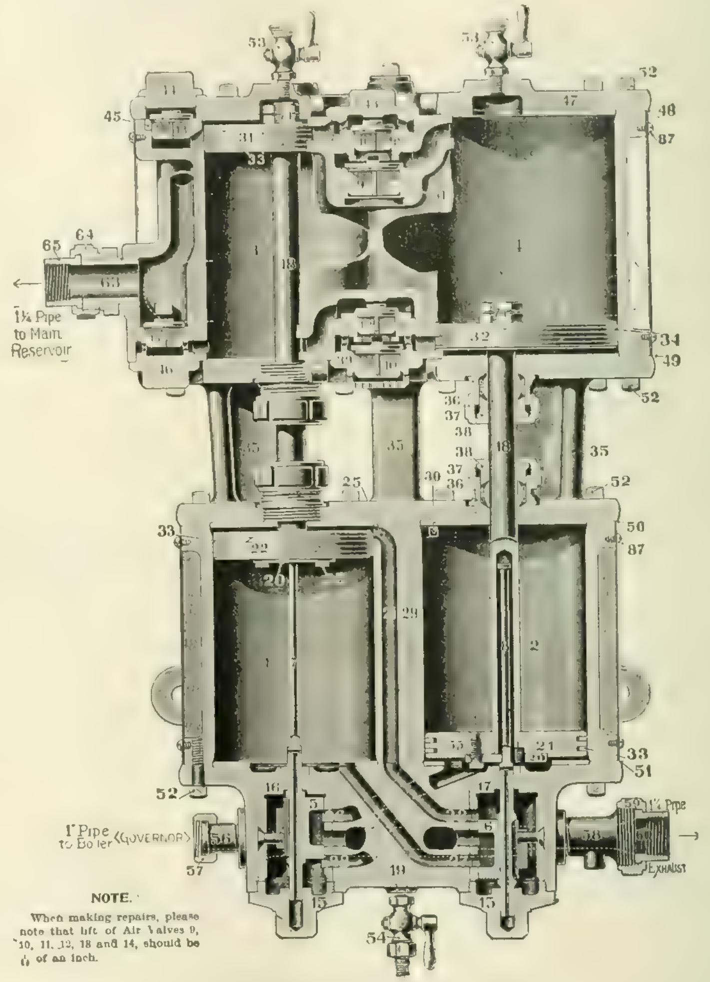
It is possible for leakage to exist around the upper receiving air valve seat 41, and also the lower receiving air valve chamber 39, if these are loose; and this should be borne in mind when testing for leaky air receiving valves. In fact it is always a good plan before commencing the test of the air end of the pump, to try all caps and pipe connections with a wrench to know that they are tight, which, if they are, there will be little likelihood of leakage around and through them.

Air valves 9 and 10 being tight, or made so, we should next test for back leakage from the high pressure air cylinder 3, into cylinder 4. To do this satisfactorily, the main reservoir should have a pressure of at least 90 pounds in it, because under working conditions the air in the high pressure air cylinder must be compressed to a pressure a little higher than the main reservoir pressure before any air will be driven past the discharging valves 13 and 14, and, therefore, it is at this pressure, if any back leakage exists, that we can obtain a correct idea of its size and importance.

With the high pressure piston 31 making its stroke, should there be any back leakage through the intermediate air valves 11 or 12, their seats 40 or 42, or around the threads on the upper end of the valve chamber 39 around the upper intermediate valve chamber 43, the air thus leaking would accumulate in the low pressure air cylinder, under or over piston 32, as the case might be, depending on whether the high pressure piston was making the up or the down stroke, and form a pressure there that would cause piston 32 to start rapidly the moment steam was admitted to its steam cylinder 2, and would cause the receiving valves 9 or 10 not to lift promptly.

Hence, the indication of back leakage from the high pressure to the low pressure cylinder is had in a quicker stroke of the low pressure piston away from the end in which the leakage exists, and it may be easily detected by noting the uneven spacing between the pump exhausts, coupled with the failure of the receiving valves to lift promptly as the low pressure piston moves away from them.

If there is any leakage through the top and the bottom air cylinder gaskets 48 and 49, at the point where they form a joint between the high and the low pressure air cylinders, it will have the same effect as back leakage through the intermediate valves. However, when these gaskets, properly annealed, are applied and the heads firmly bolted down upon them, there will be no leakage through them from one air cylinder to the other.



THE NEW YORK DUPLEX AIR PUMP.

The final discharge valves are 13 and 14. Should these valves leak, main reservoir air would flow back into the high pressure cylinder and would produce two effects simultaneously, namely, piston 31 would make a comparatively quick stroke away from the leaky final discharge valve and the air inlet and intermediate valves will not lift promptly, and if the back leakage be considerable, not at all, to admit air from the atmosphere to the high pressure cylinder, when the high pressure piston is making its stroke.

Another effect of back leakage from the main reservoir to the high pressure air cylinder will be noticed in the pound-

ing of the low pressure piston as it approaches close to the end of its stroke, which is toward the end that has the leaky final discharge valve. An intermediate air valve that has too little lift will also cause the low pressure piston to pound as it approaches it.

Back leakage into the upper end of the high pressure air cylinder may be easily detected by opening the oil cups and listening for the blow.

A little practice and careful observation will enable an engineman to detect leaky valves, to locate them properly, and hence, to report necessary repairs intelligently.

The lift of all air valves in the duplex air cylinders should be 1-16 in., and it is very important that the lift of the air valves does not vary from this.

Sometimes the receiving valves 9 and 10 stick on their seats, and do not lift when the air pistons commence their stroke away from them.

When this happens it will be noticel that the low pressure piston will make a slow stroke away from the stuck valve and a much quicker one toward it.

The condition of the packing rings in the air pistons is a very important matter, and these rings should never be overlooked when we are testing the air cylinders.

If packing rings leak, much of the air that is being compressed ahead of the air pistons will leak past them to the other side of the piston, and will help to fill that end of the cylinder from which the piston is receding, thus preventing it from drawing in as much free air as it would if the rings were tight.

To test for leaky packing rings, it should first be known that the air valves do not leak and that they have the proper lift, then with full main reservoir pressure to pump against, run the pump at a moderate rate of speed, say 30 double strokes per minute, and notice whether the suction at the air inlet valves is good during the greater portion of the stroke.

If the suction is weak and ceases altogether after the air piston has moved but a short distance on its stroke, it is pretty good evidence that the packing rings are leaking considerably more than they should.

Leaky packing rings, air valves and pump gaskets cause the pump to make irregular strokes and to heat up rapidly, and these defects will tend to cut down its efficiency considerably.

In running the pump, the speed of the piston is an important matter for consideration. If the speed is very slow, slight leakage past the packing rings counts for more on account of the longer time the air has to blow by them, while if the speed is very fast, the air is compressed in the cylinder to a higher pressure than it would be if the piston speed was such that the air passages could carry away the air as fast as the piston compressed it. Between 30 and 60 strokes per minute, depending on conditions, will be found a satisfactory speed.

With too slow a piston speed, there is loss, due to leakage past the packing rings, and with too fast piston speed, there is loss due to inability of the air passages to deliver the air as fast as the piston compresses it, and consequently the pump heats, and loses in efficiency.

With well-fitting packing rings, smooth air cylinders properly lubricated, air valves having proper lift and rod packing in good condition, and all joints and pipe connections tight, the efficiency of the pump will be kept at its highest; and when this is done, there will not be much cause for complaint from lack of sufficient air to do the work required satisfactorily, provided, of course, that the air is used economically after the pump once compresses it, and not wasted through leakage and improper manipulation of the brakes. J. P. KELLY.

Watertown, N. Y.

QUESTIONS AND ANSWERS

ON AIR-BRAKE SUBJECTS

(81) C. P. C., Harrisburg, Pa., writes:

Upon taking his engine at the roundhouse, an engineer applied and released his brake several times O. K., but several minutes later he was amazed to find that he could not apply his brakes in either service or emergency positions of the brake valve, and the gauge showed full pressures, which were 110 lbs. train-line and 130 lbs. main reservoir. In fact, he could not get any air out of the train pipe with the brake valve. This question may sound ridiculous and seems impossible, but the above statement is absolutely true. Please explain what the trouble was. A.—Inasmuch that he was unable to get any air out of the train line in either service or emergency position of the brake valve, and the gauge pointers showed no reduction, it is evident that the rotary valve did not move from some cause or other. Possibly the rotary valve and seat had been worn away either through hard service or excessive grinding, and the washer on the top of the rotary key had become so thin that the key did not fit in the keyway in the top of the rotary valve, thus permitting the key projection to slip out at its groove, and allow the valve handle and key to turn, without turning the rotary valve. Again, it might be possible that the key projection, or the slot into which it fits in the top of the rotary valve had been broken off, and prevented the turning of the rotary valve. Still again, it might have been that the stem of the key had broken, thus permitting the handle to turn, but allowing the rotary valve and the key to remain inert. The trouble was probably due to the first cause.

(82) W. B. E., Cincinnati, O., writes:

I noticed in the questions on air brakes, where in number 66 J. C. M. asks how to designate a leak on the train line side or the reservoir side of a triple valve I do not think you have answered this question quite right. Now, as you have answered it, if our man had to operate the brakes and locate defects, he could not get off of the engine quick enough to tell the difference. As I test such leaks, I charge the train up, and if I find a triple blowing I usually tap the triple lightly. If that will not stop the blow, I cut out the car or engine, whichever it may be, at the cutout cock on the branch pipe, and if the brakes apply on this car or engine, it is evident that we have a leak on the train line side of the triple. If the brakes do not set, and all of the air leaks out of the reservoir, we have a leak on the slide valve side of the triple. A.—This is also a good method, and, under the circumstances cited, is as efficient as the one prescribed.

Latest Air Brake Book.

The eighteenth edition of the "Up-to-date Air Brake Catechism," by Robert H. Blackall, comes to us fresh from the press in revised and enlarged form, containing 300 pages of reading matter and an unusally large number of illustrations.

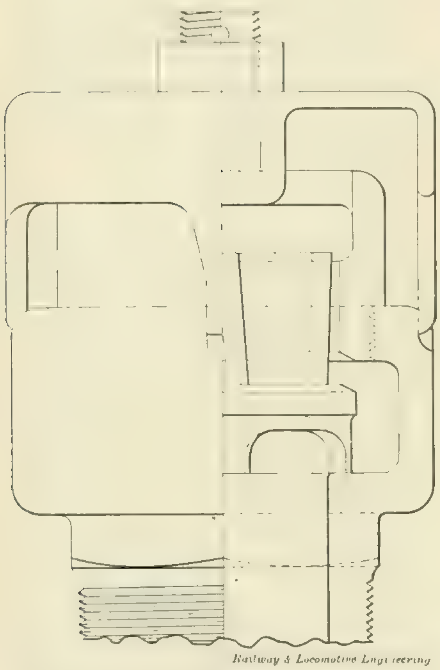
The book is really up-to-date, having been purged of obsolete matter, and retaining only sufficient on out-of-date devices to make the history of the air brake art complete. The various devices are so carefully treated, their possible disorders so clearly explained, and the latest practices and tests recorded, that a student assimilating the information proffered, and combining it with his every-day practical work will have the satisfaction of knowing that he is well up on air-brake work.

Accompanying this revised work are two colored educational charts. The first is on the modern high speed brake and signal equipment used on passenger engines, passenger tenders and passenger cars. The other shows the standard equipment for freight engines, tenders and cars. These charts are especially handsome, being over four feet in length and printed in bright colors on a substantial linen paper. The book is cloth bound. and the price is $2.00, including the colored charts. The two charts may be had alone for $1.00. Both on sale at this office.

The 1903 proceedings of the Air Brake Association treats fully on frozen train pipes, their causes and methods of correction, containing report and discussion. The books are bound in leather and paper. 75 and 50 cents, respectively.

Steam Turbines for Factory Driving.

The Eaton Cole & Burnham Company, of Bridgeport, Conn., are preparing plans for a turbine plant which will furnish power to their works located at Bridgeport, Conn. Large extensions to the present works are now under way, and the entire plant will then be operated by polyphase motors from the new power station. A 400-kilowatt Westinghouse turbine unit will be immediately installed to provide additional power during the construction work. It will temporarily be installed in the present power house and will operate under 200 pounds steam pressure and 28 ins. vacuum without superheat. The unit will furnish three-phase current at 440 volts. The installation is in charge of Mr. Geo. Hooper, engineer, No. 11 Broadway, New York.



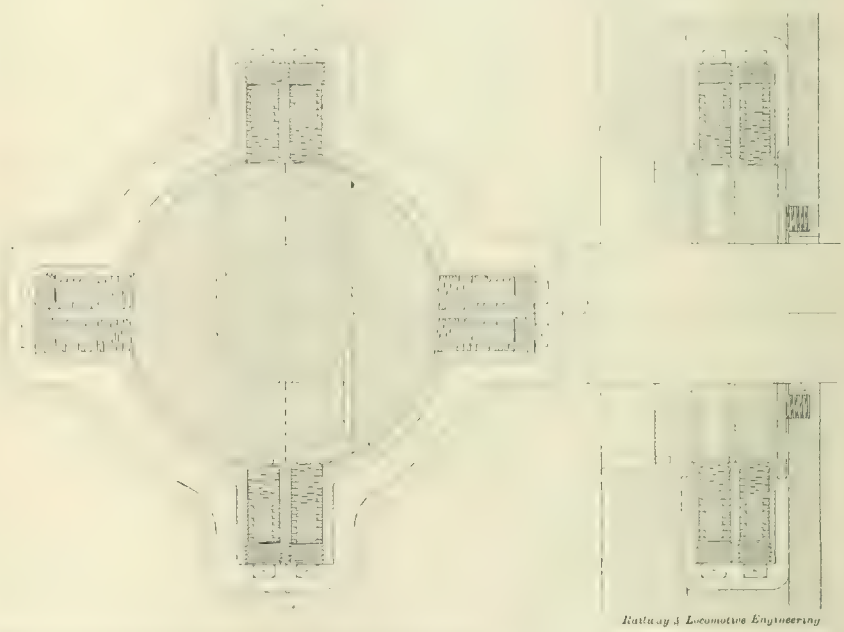
SANTA FE 2-10-2 RELIEF VALVE FOR DRIFTING.

Tired Locomotives.

When a piece of superstition gets into some people's minds, no force on the earth or in the air above will drive them back to common sense. The following ancient gag is taken from a Milwaukee paper and displays the ancient superstition that comes up periodically to worry people who are naturally interested in locomotive matters even when they express silliness:

"During the past few mornings the Pioneer Limited on the Milwaukee road from the West has been arriving in Milwaukee from forty minutes to an hour late. These delays are said by railroad men to be the result of the heavy trains now being drawn, and also from the fact that the company's locomotives have nearly all been overworked during the past summer and this fall. Unless a locomotive has its regular time to rest and recuperate, it becomes unsteady and uncertain, much like an overworked horse or man. The business on the road has been so heavy in the past six months that more work has been required of locomotives than they are intended to do or can stand and the result is trouble. A number of newly built locomotives for the road are expected to be received within a week or two, when some of the hard worked ones will be given more vacations than they have had in months."

The first number of the seventh volume of the Book of the Royal Blue, that for October, has just come to hand. The first article is on the Louisiana Purchase Exposition, and is devoted to the consideration of Power. It is beautifully illustrated with half-tone engravings. The New Union Station at Washington, D. C., is illustrated and described. Mr. H. H. Bryne contributes an article on Berkeley Springs, the Fountain of Youth. The proposed B. & O. articulated freight locomotive weighing with tender in working order, 415,000 lbs., is shown in a line cut with specification and dimensions. Two historical articles conclude the intellectual menu. One is on the town of Frederick, Md., the home of Francis Scott Key, the writer of the "Star Spangled Banner," which has recently, by government order, become the national anthem of the United States. The other article, by R. M. Cheshire, is on the Story of Bladensburg and the Sacking of Washington. Any one desiring to know how Key came to write the words of our national anthem while war was going on should send to the manager of passenger traffic, B. & O., Central Building, Baltimore, Md., and ask for a copy of the October issue.



SANTA FE 2-10-2 SELF-ADJUSTING PISTON-ROD PACKING BETWEEN CYLINDERS.

A petition in involuntary bankruptcy against the New York Car Wheel Works, of Buffalo, was filed in the United States District Court, one day last month, the petitioners being the Rochester Car Wheel Works, of Rochester; the Keystone Car Wheel Company, of Pittsburg, and Timothy J. Murphy, of New Jersey. The petition shows that the claims of the three petitioners aggregate about $30,000. It is also set forth in the petition that the aggregate amount of the liabilities of the New York Car Wheel Works is about $800,000. Assets are said to be about $250,000. A movement was made recently to combine all these wheel makers in a trust, but it does not seem to have exercised much saving grace.

An increase in wages to 8,000 employees of the twenty car and locomotive repair shops of the Chicago & Northwestern Railway has been granted. The increase means an additional expense to the road of $300,000 a year. The agreement recognizes the union and grants an advance in wages of from 1 to 2½ cents per hour. The men are members of the International Association of Car Workers of America.

The Rand Drill Company, of 128 Broadway, New York, have issued a folder dealing with their "Imperial" pneumatic tools. It explains, by half-tones and by letter press the merits of the various tools made. The "Imperial" motor running at 3,000 revolutions per minute; the "Imperial" piston air drill; the "Imperial" air motor hoist; the "Imperial" breast and screw feed drill; "Imperial" air hammers, and the "Imperial" air compressors. The folder contains twelve pages and gives in compact form a lot of information on air tools.

Baldwin 2-10-2 for the Santa Fe.

The Atchison, Topeka & Santa Fe has recently been buying very heavy freight power from the Baldwin Locomotive Works of Philadelphia in the shape of some tandem compound 2-10-2 engines, each of which weighs 287,240 lbs. The cylinders are 19 and 32x32 ins., and the driving wheels, of which there are five pair, measure 57 ins. With 225 lbs. steam pressure, the calculated tractive force which can be exerted on the level, at slow speed, is about 62,730 lbs.

In this engine the main drivers are the only wheels without flanges. In the matter of equalizing, the main drivers, the back intermediate, and the trailer are, with the rear carrying wheel, all equalized together, and the forward intermediate, the leader and the pony truck are equalized together. The springs are all overhung. The valves are actuated by indirect motion in the usual way.

held in place without internal bolts. This is accomplished by means of a casing or packing box in which the segmental sections of the packing are held and kept in contact with the piston rod by means of suitable springs. The whole packing box has a steam-tight bearing in the recess between the two cylinder heads, but is free to move on this bearing without breaking the joint, thus accommodating itself to any slight variation in the position of the rod. A piston valve is used and so arranged as to avoid all necessity of crossed ports.

The steam pipe joint between the steam chest and the cylinder saddle is made with a stuffing box and gland in order to give a certain amount of flexibility and by its use a tight joint is secured after the cylinder has been bolted permanently to the saddle.

There is a relief valve inserted in the dry pipe, the stem of which valve

The tender has a steel frame and the tank, with its deep water bottom, can contain 8,500 gallons, with corresponding coal capacity. The total weight of engine and tender is about 450,000 lbs., and the total wheel base of both taken together is 66 ft.

A few of the principal dimensions are as follows:

Cylinders—19 and 32x32 ins.

Boiler—Type, wagon top; dia., 78¾ ins.; thickness of sheets, [illegible] and [illegible] ins.; working press., 225 lbs.

Fire box—Length, [illegible] ins.; width, [illegible] ins.; depth front, [illegible] ins.; back, [illegible] ins.; thick. of sheets, sides, [illegible] in.; back, [illegible] in.; crown, [illegible] in.; tube, [illegible] in.; water space, front, [illegible] ins.; sides, [illegible] ins.; back, 4 ins.

Heating surface—Fire box, 210 sq. ft.; tubes, 4,586 sq. ft.; total, 4,796 sq. ft.; grate area, [illegible] sq. ft.

Driving wheels—Dia., outside, 57 ins.; journals, main, 11 x 12 ins.; others, 10 x 12 ins.

Wheel base—rigid, 19 ft. 9 ins.; total engine, 35 ft. 11 ins.; total engine and tender, 66 ft.

Weight—on driving wheels, 234,580 lbs.; on truck, front, 23,420 lbs.; on truck, back, 29,240 lbs.; total engine, 287,240 lbs.; total engine and tender, about 450,000 lbs.

VAUCLAIN TANDEM COMPOUND 2-10-2, FOR THE SANTA FE.

A noticeable feature is the small permanent crane placed on the smoke box on each side. It is intended for use in removing the forward or high pressure cylinder. There is a tapped hole in the cylinder which is so placed that when the threaded eye-bolt of the crane is screwed into it, the cylinder will balance when swung by the crane.

The arrangement of the cylinder heads and the connection between the high and low pressure cylinders are such that they are securely held in position without the use of interior bolts. By removing the external bolts, which hold the cylinders together, the high pressure cylinder and the front head of the low pressure cylinder can be easily taken down, giving free access to the piston and interior of the low pressure cylinder, without removing the guides, breaking the joints of the back head, or interfering with the steam chest valve.

A piston rod packing between the two cylinders is so arranged that the parts are confined between the two heads and

comes out through the top of the smoke box about midway between the sand box and the smoke stack. This valve is for the purpose of admitting air into the steam pipes in the smoke box, when the engine is drifting. The boiler is of the wagon top type, and measures 78¾ ins. at the smoke box end. There are 391 tubes 2¼ ins. diameter 20 ft. long, and these give a heating surface of 4,586 sq. ft. When the amount in the fire box is added to this it brings the total heating surface up to 4,796 sq. ft. An idea of this area may be had by saying that if the width of the regular right of way of a single track railroad between fences is 66 ft., then it would require a strip of that width 72⅔ ft. long to equal the heating surface which is stowed away in this boiler. The whistle, as will be seen in the illustration, is placed in a horizontal position, where it is attached to the auxiliary dome, otherwise it would be higher than stack or headlight.

A new type of locomotive lubricator has lately been put upon the market by the Detroit Lubricator Company, of Detroit, Mich. Considerable interest has been manifested in it by railroad officials and enginemen. The sight feed feature of this new lubricator will probably help to make it popular with those who have to use it in locomotive service, as it consists of glass disks about 1 in. thick, so that the danger of breakage is practically removed. It has very few joints, and thus the chances of leakage are considerably reduced, and it has, perhaps, only a little more than half as many parts as the regular type of lubricators have. The manufacturers will be pleased to send descriptive matter concerning this lubricator to any one who will write them for it.

It is reported that the Rogers Locomotive Company have purchased considerable property in Paterson, N. J., for the purpose of extending the works.

European Railway Doings.

The summer traffic on the British railways invariably stimulates the different departments to do their best with competitive traffic, and this year has proved no exception, new engines for fast service having been introduced on most of the trunk roads leading out of London. The keen running between the Metropolis and Scotland has been resumed and both East and West Coast routes are making best efforts by cutting cut intermediate stops and offering quick and luxurious equipment to their patrons.

The fast run to the West on the Great Western Railway in June with the 10.40 A. M. express from Paddington Terminus with the Prince of Wales on board, opened the ball so far as the holiday traffic in that part of the country was concerned.

The train was hauled from London to Plymouth by a four-coupled locomotive, No. 3433, "City of Bath," having drivers 70½ ins. diam. and cylinders 18 ins. by 26 ins. The photograph reproduced shows the "flyer" ready for the road. The 243¼ miles from Paddington (London, W.) to North Road (Plymouth) were covered in 233½ minutes, 36½ minutes ahead of schedule. The engine ilustrated is one of a very numerous class which is being continually added to, but the latest sent out from the Swindon shops has a much larger boiler, 66½ in. diam.; the railway people having fallen in line with others and admitted that a large boiler is essential for fast running.

The opening of a new direct line cuts the distance by the G. W. R. between London and Bristol to 117 miles and the fastest trains are timed to cover this in 128 minutes. The rival road to the West, the London & South Western Railway, has put on some larger engines and quickened up some of the best trains. The photograph of 395 has water tubes across the fire box, arranged on the patented plan of the chief of motive power, Mr. D. Drummond

The London, Tilbury & Southend Railway, a road running parallel with the north shore of the River Thames, had, until recently, but one type of four coupled tank engine (4-4-2) for passenger and freight service, but owing to the considerable insrease in the latter, a new type of locomotive has been introduced of which a photograph is appended. Six are at work and have cylinders inside the frames and six coupled drivers (0-6-2). The headquarters of the locomotive department of this road are at Plaistow, an eastern suburb of London and the next photograph shows the running shed at that place.

A fast run was made on July 26 from London to Brighton with the Pullman Limited Express. This train is composed entirely of Pullman cars and is timed to run between the two cities in one hour. On the occasion named it performed the journey in 48½ (forty-eight and a half) minutes. The locomotive was No. 70, "Holyrood," which has drivers 81 ins. diam. and cylinders 19 ins. by 26 ins.

In Scotland the Glasgow & South Western Railway has put into service some ten wheelers (4-6-0), of which the following are the chief dimensions:

Cylinders, 20x26 ins.; H. S. of boiler, 1,852 sq. ft.; grate area, 24½ sq. ft.; drivers, diam., 78 ins.; working pressure, 180 lbs. per sq. in.

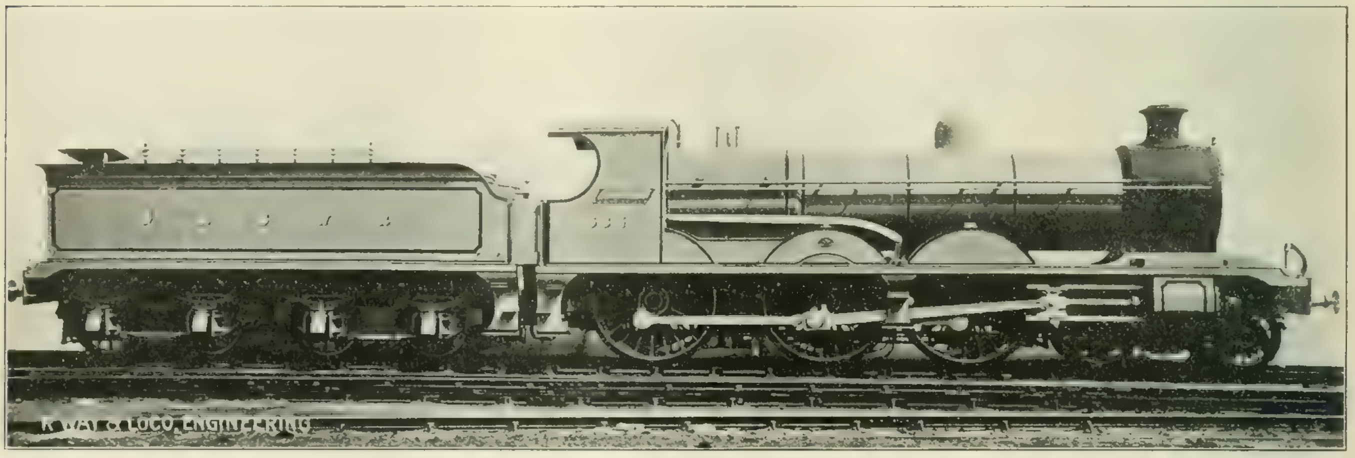
These engines haul the Midland Scotch trains between Carlisle and Glasgow.

The rush to the North sets in at the beginning of August, and the distributing centers of Edinboro', Glasgow, Perth and Aberdeen are besieged with tourists. The Waverley Station at Edinboro' is one of the largest in Europe and has lately been completed by the construction of a very fine hotel fronting on Princess street at Aberdeen, the Granite City, the final cutting up of the trains with passengers for the Highlands takes place here.

The visit of the King and Queen to Ireland required the provision of a handsome special train which was built by the Irish Great Northern Company at their Dundalk shops, and which is shown in the photograph herewith. The Midland Great Western Company also provided some cars built in Dublin.

In Russia the railways of the South have been completely stopped by strikes among the employees, the chief centers of disturbance have been Kieff and Baku, the oil producing city. The views are from the camera of a gentléman who has visited those parts. At Kharkoff, the headquarters of the Kursk and Sebastopol system of the State Railways are located. The miserable lot of the Russian worker is no doubt answerable for the troubles, at the same time the amount actually *earned* by the individual is but a fraction of that secured by his British or American brethren. It takes six men in Russia to do one man's work calculated from the English standpoint, and as for holidays. Saints' days, and "Don't-do-any-work days," the loss of time is deplorable.

The terrible accident on the Metropolitan Railway in Paris has struck consternation among the "tube" makers. The section on which the mishap occurred is the last opened and newest. It appears clear that if the motorman of the first defective motor had obeyed his printed instructions, no collision would have happened, and no catastrophe would have resulted. The uncontrollable excitement of the French people seems to have added the greater number of victims.



PASSENGER 4-6-0 ENGINE ON THE GLASGOW & SOUTH WESTERN.

The Commonwealth Steel Company

The Works of the Commonwealth Steel Company are situated at Granite City, Ill., close to the city of St. Louis, Mo. There are at present on the pay rolls about 1,200 men, and the output of the plant is 3,000 tons of steel castings a month. These are almost exclusively railroad castings, and include some small locomotive steel frame castings for the Davenport Machine Works, of Davenport, Ia. The Commonwealth now makes practically all the steel castings used by the Santa Fé Railroad.

Among its products regularly turned out may be mentioned the Commonwealth

Truck, which combines the M. C. B. standard arch bars with improved bolster and column steel castings. Their swing truck is composed of the ordinary diamond side frame, combined with the Commonwealth bolster end casting and swinging spring seat. The Commonwealth

ROYAL TRAIN ON GREAT NORTHERN RAILWAY.

steel truck bolster has the metal distributed so as to withstand all the shocks incident to severe service. In it the tension and compression members are made as

LONDON AND SOUTH COAST EXPRESS ENGINE WITH DRUMMOND BOILER

nearly flat as moulding will permit and are reinforced by vertical ribs to provide against shear loads and buckling. Their body bolster has its top member bifurcated to increase its bearing surface and transverse stability without increase of weight. The bottom or compression member is of inverted T-section which provides for both compression and shear loads. The separable body bolster is designed to permit of the removal of continuous draw timbers, without the necessity of removing their attaching bolts. By removing the center plate and the nuts from the draw timber bolts, the draw timbers may be removed and replaced while car is under load.

For the past year the following orders have been booked: Separable body bolsters, Missouri Pacific for 5,300 cars; by D. & R. G. for 750 cars; Wabash for 1,500 cars; by Mexican National for 500 cars; by New York Central for 500 cars; by Santa Fé for 1,200 cars; for National Coal Dump Co. for 5 cars. Special trucks on the following lines as follows: Chicago Great Western for 700 cars; St. Joe & Grand Island for 250 cars; Interborough Rapid Transit for 350 cars; Lawson D. C., 5 cars. Standard truck and body bolsters: C., B. & Q. for 2,250 cars; Mexican Central for 1,100 cars; Atlantic Coast Line, 400 cars; Mexican National for 500 cars; Bellington & Beaver Creek for 300 cars; Union Pacific for 100 cars; Coal Blast for 100 cars; Cudahy Packing Co. for 100 cars; Stewart-Peck Sand Co. for 10 cars; K. C. Refrig. Car Co. for 20 cars; New York Central for 250 cars; Grand Trunk for 25 cars; Jacob Dold P. Co., 5 cars; M., K. & T., 1,100 cars; C., R. I. & P., 10 tenders; C., N. O. & T. P. for 2 tenders; E. & T. H., 137 cars; Coal & Coke Co., 400 cars; Lehigh Coal & Coke Co., 20 cars. This is considered a splendid record for the first year's business of a new company, and it is all the more gratifying as the shops are now working full time.

LONDON, BRIGHTON AND SOUTH COAST EXPRESS ENGINE.

Economy of the Gas Engine.

In a paper on Internal Combustion Engine in Railway Service, Mr. R. P. C. Sanderson, S.M.P., Seaboard Air Line, says:

"Had the internal combustion engine been invented before the steam engine, it is reasonably certain now that the latter would never have been developed and assumed the important standing in the industrial accomplishment that it has to-day, but the internal combustion engine would be in its place, doing its work and very much more efficient than it is to-day.

"The mechanical genius of this country and Europe has for years been striving with really wonderful results to improve the efficiency of the steam engine, and when we compare the high pressure, quadruple expansion steam engines with surface condensers of to-day with the long stroke, low pressure single expansion engines of fifty years ago, the coefficient of efficiency tells the story of the progress made during that interval of time in perfecting the steam engine and boiler.

"But, apart from the perfection of workmanship and design of the boiler and the skill in making the engine develop the greatest amount of power with the least amount of steam, there are inherent losses in the process of converting the energy of coal or oil into power at the crank, which can never be eliminated in the steam engine and boiler. No boiler can be made which will absorb all the heat which can be given by the coal. There is a loss in the boiler due to the evaporation of water into steam and other losses with which we are all familiar. The process itself is an extravagant and wasteful one.

"To illustrate this, if we take an engine of reasonable efficiency in ordinary service (I do not now refer to the highest type of multiple expansion or condensing engines), with a reasonably good boiler, we cannot expect to get a brake horse power for much less than five or six pounds of coal per horse power per hour.

"In the present imperfect condition of the internal combustion engine there is no difficulty in getting a brake horse power for one pound of coal per hour from producer gas, where nothing is wasted but

the ashes, and, of course, some heat in the producer itself necessarily, due to the change of the carbon from its fixed form into that of fuel gas."

One Way of Measuring Horse Power.

In the course of a speech made at a social meeting of the Northwestern Railway Club Professor Flather said:

"To succeed in railway work one must learn the value of thoroughness and hard work. It has no shifts. It has been said that success is made up of about 30 per cent. of knowledge, personal experience, skill and education and 70 per cent. of hard work. And so it is in the railway service, it isn't the shifts that make success, but it is the hard work that every one who attains to the higher positions must accomplish. To-day we have great opportunities given to the engineering student. Our colleges, our technical schools, our laboratories, our mental training schools are so numerous throughout this great country in which we live, that almost every boy is familiar with the general principles of mechanics, and knows what horse power is and knows, frequently, the general principles of the dynamo and of the steam engine. It was not so formerly. Not a great many years ago the matter of horse power was a very intricate subject. I recall a story in which it is related how the early steamboat boilers had to be filled with some extraneous material in order to allow them to carry steam properly. Sometimes to-day we find engineers putting bran in boilers in order to close the seams, and in early days this was also appreciated; it was necessary to put in some extraneous material for the same purpose. One time a steamboat had been built on the Hudson, had been finished and equipped with its machinery and the boilers were ready to fire. At the last moment a two-horse team drove up with a by-product of a livery stable and dumped it on board the boat: the man-hole was removed and the by-product put inside of the boiler. A young man standing on the bank had watched these proceedings very interestedly, and when he finally saw this manure going inside of the boilers he said: 'Well, I never understood before how it was they measured the horse power of a boiler, but now I know.'"

LONDON, TILBURY AND SOUTHEND SUBURBAN ENGINE.

An automatic bell ringer on an engine is a good thing for several reasons. With it in working order the bell is rung continuously, so that when between stations there is no road crossing but hears the bell. The fireman's attention is not distracted looking after the bell and the engineer need not worry, the ringer just takes the responsibility off their shoulders. An exceedingly good ringer which knows how to keep the bell busy is the Sansom bell ringer. It is operated by compressed air and it has its valve motion outside the cylinder, with a plug valve held in place by a spring and the stroke of the bell can be adjusted by nuts on the valve rod. The piston has a leather packing ring and a leather cup on the bottom, which have good lasting qualities and can be replaced in a few minutes by either of the engine crew. The valve gear is arranged so as to prevent any jumping of the piston while the bell is making its stroke. It is a good reliable ringer and when it is doing its work continuously you can go into court, if necessary, and testify surely that the bell was ringing. C. M. Hammett, Troy, N. Y., is the man to write to if you are interested in bell ringers.

The American Railway Engineering and Maintenance of Way Association has issued a pamphlet which contains specifications for Portland and Natural Cements adopted 1903. The pamphlet also contains the specifications for concrete, submitted by the Committee on Masonry. Price, 10 cents. 1562 Monadnock Building, Chicago.

The fourth index of the technical press has come to hand. It is four times the size of the first issue. The references are in English, French and German. The principal articles which are of general interest, taken from the technical journals of the world, are catalogued under appropriate heads. The book is published by the Association de la Presse Technique, 20 Rue de la Chancellerie, Brussels, Belgium.

The Lincoln & Williams Co., Taunton, Mass., successors to the Lincoln & Wood Co., have purchased the large factory building formerly occupied by the Atlas Tack Corporation, and will continue in it the manufacture of twist drills. The new concern has available more than 30,000 feet of floor space, and will make extensive improvements in their property. The plant will be newly equipped with up-to-date appliances.

GREAT WESTERN HEAVY EXPRESS ENGINE.

We must trust and hope, and neither doubt ourselves, nor doubt the good in one another.—*Chimes.*

Signals and Signaling.

BY GEORGE S. HODGINS.

Historical Retrospect.

When that taciturn yet kindly old man, whom Dickens humorously called Barbox Brothers, took a walk for the purpose of seeing Mugby Junction by daylight, he naturally turned to the railways —"But there were so many lines. Gazing down upon them from a bridge at the Junction, it was as if the concentrating Companies formed a great Industrial Exhibition of the works of extraordinary ground spiders that spun iron. And then so many of the lines went such wonderful ways, so crossing and curving among one another, that the eye lost them. And then some of them appeared to start with the fixed intention of going five hundred miles, and all of a sudden gave it up at an insignificent barrier, or turned off into a workshop, * * * there was no beginning, middle, or end, to the bewilderment."

The picture here given and in what

ANCIENT SEMAPHORES.

follows, of the intricacy of an interlocking plant such as Rugby Junction, must have appeared to a layman, even in the days of Charles Dickens, is not overdrawn in the least. It is only when the whole wonderful system of block signaling and interlocking, complete as we know it to-day, is analyzed, that it is found to be not the work of one man or of one time, but to be the result of a slow growth or evolution from very small beginnings indeed.

The art of signaling and the use of semaphores was known and practised long before railroads had any existence. The word semaphore, from the Greek *séma*, a sign, and *phero*, I bear, means simply "sign bearer," and as early as 1749 the French made and used them for military purposes. In 1750 they were introduced into England and were used by the Board of Admiralty in London to communicate with seaport towns. These semaphores were mounted on towers, built at intervals of from five to ten miles on commanding sites. The earlier forms had six shutters arranged in two frames on top of each tower and by the operating of these flat movable pieces of wood, in various combinations, sixty-three definite signals could be given. In 1816 a mast with two arms was substituted, and this was practically the forerunner, in form at least, of the now well-known railway semaphore signal. The last message which passed over this crude semaphore system between London and Portsmouth was sent on 31st December, 1847, after which the electric telegraph made its appearance and took the field.

The semaphore, thus displaced by the more rapid and more certain means of communication, was nevertheless destined to appear again and to take an accepted place in what may be called its own legitimate sphere—that is the giving of a certain definite piece of information in a most unmistakable way. The semaphore appears to have been one of those contrivances, which Nature, as it were, suggested to man. What is more natural than the erect body and the arms outstretched across the path, when it is desired to stop any living object which is approaching? The semaphore is but a man of wood or iron with the sole ability to raise or lower his arms, and actuated by some outside intelligence, assumes the "stop" position with outstretched arm, as naturally as if the imitative action had been handed down from father to son. In fact whatever may be said as to what *ought* to be the position of a signal showing "danger," the semaphore has come by its attitude, honestly and antidates all other forms or positions.

In 1830, when the Liverpool and Manchester Railway was opened, the signaling of trains was carried out by means of a flag held in the hand of the pointsman in day time, or a lamp in his hand at night. The general instructions of the Great Western Railway issued in 1865 shows the "police switchman" of that day clad in the regulation swallow-tail coat of the period and the tall hat which was the ancient form of our modern "stove pipe."

Four years later, stout posts were set up at convenient points, on which flags or lamps were placed by the pointsmen to indicate the position of the rails at switches, and this innovation marks the first step in the direction of establishing fixed signals on a railroad.

In 1837, the opening of the Grand Junction Railway, saw the introduction of station signals. These were practically an early form of the now familiar switch target and light, but were then used to indicate whether an approaching train must stop at the station or go on. The edge of the disc or a white light indicating "go on," and the face of the disc displayed or a red light, indicating "stop." A very ingenious form of disc signal, invented about 1840, was used on the London and South-Western, practically as a distant signal as it stood outside the yard. A disc, rotated about its center, was made with one-half only being solid; the other half being open, with a bar across the clear space. The disc was turned by a cord, passing in a groove around its circumference. When the solid or blocked portion was turned to the right, it indicated that the line of rails branching to the right was blocked, and the left-hand line was clear and vice versa. When the disc was placed so that the blocked portion of the disc was on top, the indication given was that both main track and siding were blocked.

About 1842 the familiar semaphore signal made its appearance in railway work,

POLICE SWITCHMAN, G. W. R.

Reproduced from *The Railway Magazine*.

introduced by Mr. C. H. Gregory. Three positions of the arms being possible; the horizontal—danger; the vertical—go on; and the angle of 45°—slow speed; the semaphore easily displaced the two-position disc. Four years later, the idea of working a signal at a distance, dawned on a pointsman who had two semaphores placed some distance apart. He rigged up two levers near his cabin, and attaching wires to the lever of the signals, and improvising suitable counterweights, he succeeded in performing his duty without having constantly to walk to and fro.

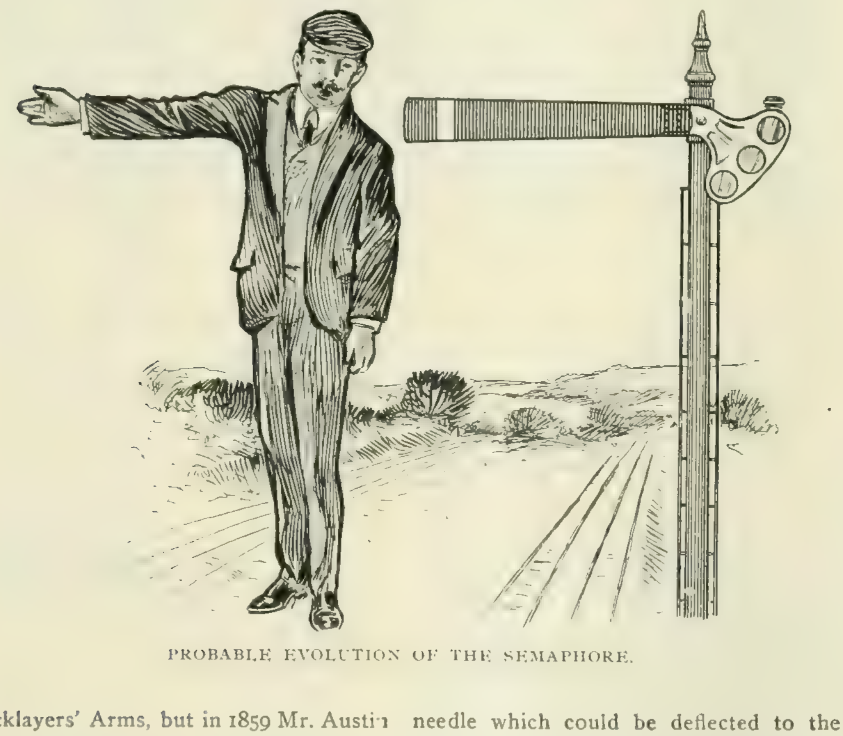
The year 1843 saw what may be called the birth of the interlocking idea. The contrivance was, of course, very crude, and its scope of operation limited, but it embodied the principle which makes interlocking signals trustworthy, and this is, that with it conflicting indications can-

not be given at the same time. The mechanism for operating was so arranged at a junction that it was impossible for a signalman to lower the semaphore governing the branch line while the main line signal stood at "clear," and when the branch was "clear" the main line had to show "stop."

In 1846 the practice of grouping the levers in one or more cabins, for working adjacent signals, was adopted on several roads, though at this time there was no attempt made to lock the rails by the signal mechanism, and the idea of providing that no false indication could be given, had not yet been conceived. Ten years later Mr. John Saxby made the first apparatus in which the concentration of all the signal levers at a station, into one tower and their interlocking was successfully carried out. This was done at a junction in London called the Bricklayers' Arms, but in 1859 Mr. Austin Chambers installed the first interlocking plant worthy of the name, on the London and North-Western Railway.

While the interlocking principle as applied to railway signals was being gradually worked out, the block signal idea was, by the introduction of electricity, also made a factor in railway operation. In 1842 a pamphlet was issued by Sir William Cook, in which he advocated the regulation of traffic on a single track by dividing the line into sections or blocks. The rule laid down was that when a train entered a block no other train should be permitted to enter that block until the first train had passed out of it, and until that section of the line had been signaled "clear" to the point of entrance of the block. By this method trains are kept apart, not by an uncertain time interval, but are always separated by a certain distance or space, and that is the block system in essence.

In 1839 Cooke and Wheatstone induced the Great Western to use their newly invented electric needle instrument, to telegraph the arrival and departure of trains between Padington, Dayton and Hanwell. The block system idea was here carried out as under this arrangement, for unless "arrived" was telegraphed concerning any train on the line, from one of the stations, the following train was held. The first practical application of the block system was in 1844, when the Great Eastern Railway divided its line between Norwich and Yarmouth into five sections. The electric instrument here employed to transmit signals was one having five dials, each bearing the name of one of the five stations along the line. Each dial had a needle which could be deflected to the right or left, and so made to indicate by pointing to the designating words, the presence of an "up" or a "down" train in any given block. Thus all the stations were informed of the movement of trains, though each operator manipulated only the needle belonging to the block for which he was responsible at the time.



PROBABLE EVOLUTION OF THE SEMAPHORE.

Mr. C. V. Walker, the telegraph engineer of the South-Eastern Railway, introduced in 1851 a system of block signaling in which a bell struck by a hammer gave an audible signal. This system worked exceedingly well, though it was faulty in a very important point. Nearly all the other forms and methods of early electric block signal instruments employed a bell as an adjunct to the visible signal, the bell being designed simply to attract the operator's attention. The Walker system depended entirely upon the strokes on the bell, and of course any signal so given was not permanent.

About 1854 Mr. Edwin Clark devised a system which was far less costly to operate than the five-dial instruments of the Great Eastern Railway. The apparatus used by Clark was the "double needle," which also had an alarm bell with which to attract the operator's attention. The London and North-Western used this system. Each block had its own dial, so that each station was equipped with an instrument with two dials, one for the block north and one for the block south. When the handle was moved to the right the needle pointed to "train on line," and when moved to the left, it pointed to "line clear." The handle could be pegged in either position, so that the indication remained fixed until altered by the operator. The lower end of the needle, indicated, by its vertical position, when the current was interrupted, "Line Blocked" or "Instrument out of order." A small wire forming part of the circuit was carried down every alternate post in the form of a loop, so that the guard of a disabled train could produce the "Line Blocked" indication by cutting the loop wire on the nearest telegraph post. The Great Northern adopted the block system in this year, 1854, but the instrument used on that line did not permit the handles to be pegged over to right or left as in Clark's device.

During 1852 the first attempt at automatic block signaling was made. Mr. Tyer induced the Brighton and South-Eastern lines to try it. The instrument installed was provided with indicators, and these were actuated by the movement of a treadle, placed close to the rail, and which was depressed by the wheels of a passing train. The train itself thus automatically sent an indication to the station next ahead, but in 1854 the automatic feature was abandoned, and the work of transmitting the signal was again placed in the hands of an operator.

In all the instruments described, it must be remembered that operators received and sent the signals. On receiving an indication, from a distant station, it was the duty of the operator to raise or lower the semaphore arm, and so convey the desired intelligence to the men on the engine. There was no safeguard against the operator's failure to display the corresponding signal to the indication he had received, and in abandoning the crude automatic system the Brighton and South-Eastern clung to the "fallible human element," unchecked by any mechanical device in the important business of signaling in train operation.

The year 1862 saw the London and South-Western Railway open their line between Exeter Queen street and St.

(*Continued on page 527.*)

Of Personal Interest.

Mr. Robert Rennie, mechanical engineer of the St. Louis & San Francisco, has been made shop superintendent, with headquarters at Springfield, Mo.

Mr. J. Francis Lee has been appointed second vice-president and general manager of the Valdez, Copper River & Tanana Railway Company.

Mr. Leslie G. Roblin has been appointed locomotive foreman at London, Ont., on the Canadian Pacific Railway, vice Mr. J. Wilkinson, resigned.

Mr. J. A. Carroll has been appointed to the position of road foreman of engines of the Albuquerque Division of the Atchison, Topeka & Santa Fe.

Mr. S. Rothwell has been appointed mechanical superintendent of the Brockville, Westport and Sault Ste. Marie Railway, vice Mr. H. Wilkinson, resigned.

Mr. Robert Preston has been appointed master mechanic on the Ontario Division of the Canadian Pacific Railway, with headquarters Toronto Junction, Ont.

Mr. James R. Bunce has been promoted to be road foreman of engines, with jurisdiction over the 25th, 27th, 28th and 29th districts of the Grand Trunk, Western Railway.

Mr. H. S. Williams has been appointed superintendent of motive power and works of the lines of the Cuba Company west of Alto Cedro, vice Mr. E. D. Stegall, resigned.

Mr. J. C. Howard has been appointed superintendent of the Dakota Division of the Great Northern Railway, with headquarters at Larimore, N. D., vice Mr. L. B. Allen, resigned.

Mr. Lacey R. Johnson, assistant superintendent of rolling stock, Canadian Pacific Railway, and Mrs. Johnson, returned to Canada last month after a short but enjoyable trip in England and Scotland.

Mr. Christopher Kyle has been appointed master mechanic of the Lake Superior Division of the Canadian Pacific Railway with headquarters at North Bay, Ont., vice Mr. Robert Preston, transferred.

Mr. W. L. Pierce has been promoted to the position of trainmaster of the branch lines of the Danville Division of the Southern Railway (except the Rocky Mount Branch), with office at Greensboro, N. C.

Mr. G. V. Peyton has been promoted to the position of assistant superintendent of the branch lines of the Danville Division of the Southern Railway (except the Rocky Mount Branch), with office at Greensboro, N. C.

Mr. H. A. White, formerly mechanical accountant on the Grand Trunk Railway at the Point St. Charles Shops, has been appointed chief clerk to the superintendent of car department, vice Mr. W. H. Rosevear, Jr., resigned.

Mr. G. C. Scarlette has been promoted to the position of trainmaster of the main line of the Washington Division of the Southern Railway from Alexandria to Monroe, and of the Warrenton Branch, with office at Alexandria, Va.

Mr. Hobart B. Ayers, formerly superintendent of the Manchester Works of the American Locomotive Company, has been appointed general superintendent of the Pittsburgh Works of the same company, vice Mr. J. H. McConnell, resigned.

Mr. H. K. Gilbert has resigned as president of the Railway Appliances Company, of Chicago, and Mr. C. F. Quincy has been elected president. Mr. Geo. H. Sargent was elected vice-president, and Mr. Percival Manchester, secretary and treasurer.

Mr. J. W. Fogg, master mechanic of the Chicago Terminal Transfer Company, met with a painful accident a short time ago. He had his right leg broken above the knee by a tire falling on him. He is at the Mercy Hospital in Chicago and is reported to be making good progress toward recovery.

Mr. John Smith, who for the past ten years has held the positions of master mechanic and superintendent of car repairs at Du Bois, Pa., for the Buffalo, Rochester & Pittsburgh Railway, has resigned his position. He was popular on the road and his retirement is regretted. His present address is 416 South Main street, Du Bois, Pa.

Mr. C. E. Gossett has been appointed traveling engineer on the Chicago, Rock Island & Pacific, with headquarters at Chickasha, I. T. He entered the service of the company in 1898 as an engineer and has had an excellent record. His selection for the responsible position of traveling engineer is a promotion for which he may feel justly proud.

Mr. A. J. Fries, formerly general foreman of the New York Central Shops at West Albany, has been appointed division superintendent of the Boston & Albany Railroad Shops, with headquarters at Allston, Mass. His promotion was made the occasion of a presentation, by the entire shop force, of a handsome ring. The hearty good wishes of his many friends follow him.

Mr. A. W. Greenwood, superintendent and master mechanic of the East Broad Top Railroad, has resigned his position, after more than twenty years' service with the company. He has been an active railroad man for about forty-two years, having been on the Pennsylvania for twenty-one years, holding successively the positions of gang foreman, foreman, and assistant master mechanic at the Altoona Shops. He is at present at his former headquarters, Rockhill Furnace, Huntington county, Pa.

Mr. F. D. Cassanave, who is to have charge of the Pennsylvania Railroad's exhibit at the St. Louis Exposition, is making an extensive tour of Europe on business connected with the company's exhibit. He will visit the De Glehn Locomotive Works in France, where the Pennsylvania is having built a high class passenger locomotive. The locomotive is expected to arrive in this country about the first of the coming year. It will be thoroughly tested on the company's lines East and West and then placed on exhibition at St. Louis.

Mr. Alexander Robertson has resigned as division superintendent of the Wabash at Decatur, Ill., to become manager of the West Virginia Central and the Western Maryland roads, with headquarters at Baltimore, Md. It was on the Fitchburg railroad that he first took to railroad service in 1885 as passenger brakeman. He served in various capacities on that line till 1897, when he moved west and took service with the Wabash as general yardmaster. The following year he was made trainmaster, and in September, 1899, he was appointed division superintendent of the Wabash to succeed Mr. Garrett.

Mr. A. M. White, formerly superintendent of the New York Locomotive Works, in Rome, and who has for the past 17 years been connected with the Schenectady Works of the American Locomotive Company, occupying various positions of superintendency, has gone to Manchester, N. H., where he takes charge of the Manchester Works of the American Locomotive Company. Before he left Schenectady a deputation called on him and on behalf of the officials and the entire working force of the local plant presented to him a magnificent sil-

ver service, a diamond and emerald ring and a pair of stereo-binocular field glasses.

Mr. Howard Elliott has been elected president of the Northern Pacific Railway. He has up to the present time been second vice-president of the Chicago, Burlington and Quincy Railroad. He leaves this road to take the position recently vacated by Mr. C. H. Mellin, who has become president of the New York, New Haven & Hartford. Mr. Elliott entered railroad service in 1880, his first work being in the engineer corps of the C., B. & Q. He subsequently became clerk in the office of the president of the St. Louis, Keokuk & Northwestern. From 1882 to 1897 he was auditor and assistant treasurer of the Chicago, Burlington & Kansas City, and of the St. Louis, Keokuk & Northwestern. Later he became general freight and passenger agent of the same roads. In 1891 he was made general freight agent and in 1896 he became general manager.

Mr. Charles L. Allen, secretary and general manager of the Norton Emery Wheel Company, of Worcester, Mass., was the central figure in a very enjoyable evening entertainment given by the officers and men in the company's employ. The festivities were in honor of Mr. Allen's return from a trip abroad, and it is safe to say that few general managers have received any more cordial welcome home than he did, when greeted by the 400 employees of the company. The shops were decorated by the men with autumn leaves and flags, and shortly after eight o'clock in the evening a general reception was held in the offices. Following this, the general manager was escorted through the works accompanied by a band. In the grinding machine department a heavy silver cup mounted on ebony, with three buckhorn handles, was presented to the man whom they all "delighted to honor." Appropriate speeches were made and after a series of stereoptican views had been enjoyed the pleasant evening came to a close. The Norton people make emery wheels, it is true, but there is not a particle of friction existing in the way the works are run under Mr. Allen's management.

We have several names of men capable of filling the positions of master mechanic or master car builder, which we would be happy to give to any railroad official who is on the lookout for such men. We also have an inquiry from a leading road for a first-class boiler foreman. A man of good education is wanted.

Cheerfulness and content are great beautifiers, and are famous preservers of good looks.'—*Barnaby Rudge*

Grand Chief Engineer Stone.

Through the courtesy of Mr. C. H. Salmons, editor and manager of the *Locomotive Engineers' Journal*, we received a photograph of Mr. Warren S. Stone, the new Grand Chief of the Brotherhood of Locomotive Engineers, and are now able to present his picture to our readers. Mr. Stone was born in Iowa 43 years ago and was introduced on his father's farm to the wholesome toil that so often lays the foundation to a life of successful industry. He enjoyed the privilege of attending college for a short time, then he obtained employment as a fireman on the Chicago, Rock Island & Pacific Railway, where he rose to be a highly respected engineer. From his first connection with railroad work Mr. Stone has been an ardent brotherhood

WARREN S. STONE.

man. Latterly he became the salaried chairman of the Board of Adjustment of the Rock Island System, where he displayed so much ability as to present a commanding personality for election to Grand Chief of the Brotherhood of Locomotive Engineers. We believe that the brotherhood as well as railroad companies have reason to congratulate themselves on the selection the engineers have made.

Canadian Westinghouse Company, Limited, Organized.

At a meeting held at Hamilton, Ont., last month, presided over by Mr. George Westinghouse, the Canadian Westinghouse Company, Limited, was organized with a capital of $2,500,000.

Mr. George Westinghouse, the founder and head of the great industries which bear his name, arrived in the city in his private car at 10.15 A. M., accompanied by Mr. H. H. Westinghouse, vice-president of the Westinghouse Air Brake Co., of Pittsburgh, Pa.; Mr. John Caldwell, treasurer of the same company; Mr. Frank H. Taylor, vice-president of the Westinghouse Electric & Manufacturing Co., and Mr. George C. Smith, president of the Security Investment Company, all of the same city. They were met by Mr. Paul J. Myler, of Hamilton, who has been manager and secretary of the Westinghouse Manufacturing Company, Limited, which the new organization succeeds.

The new company, to be known as the Canadian Westinghouse Company, Limited, is a consolidation of all the Westinghouse interests in Canada, which heretofore have been conducted individually. It will take over all the property, patents and other interests of the succeeded companies, including the sales organization and business of Ahearn & Soper, of Ottawa.

Of the Greatest Intrinsic Value.

At the October meeting of the Pacific Coast Railway Club, our correspondent, Mr. D. P. Kellogg, read a paper on, "Of the Greatest Intrinsic Value to the Railway World." He described the dreams of a visionary who was cogitating on the introduction of all kinds of perfected appliances into railway service, these being the dreamer's ideal, Of the Greatest Intrinsic Value. The writer of the paper relinquishes the schemes of the dreamer, and takes up good practical education as furnishing the Greatest Intrinsic Value to railroad companies. He concludes that education, universal education, is the crying want of the age. We will devote more space to Mr. Kellogg's paper in a future issue.

Catalogue No. 36, of the Newton Machine Tool Works (Incorporated), of Philadelphia, has just come to hand. The catalogue is a book of 236 pages. An idea of the contents may be had by a glance at the alphabetical index which includes among others, eight sizes of boring machines, twenty-nine cold saw cutting-off machines, ten duplex milling machines, forty-seven different kinds of milling machines, twelve plain milling machines, eleven planing machines, eleven rotary planing machines, thirteen slotting machines, and others "too numerous to mention," as the saying is. The catalogue is neatly printed and the illustrations of the tools are clear and well defined. Each page is devoted to some tool and contains a cut and descriptive matter which gives sizes and other data and where necessary mentions the kind of work which can be done on the machine. Write for the catalogue if you want a bird's-eye view of up-to-date shop equipment.

Mechanical Work Active on the Pennsylvania Systems.

There appears to be a lull generally in the demand for railroad rolling stock, but the Pennsylvania Railroad Company does not display any indication of reducing the output of their shops during the coming year.

We understand that Superintendent of Motive Power R. M. Durborow, in charge of the works at Altoona, will receive within a few days the list of engines and cars that are to be manufactured at that place. An exceptionally large order will be made on the Juniata shops, the capacity of which will be increased about 25 per cent. by reason of the additions that have been made during the past year. The most of the new work will be given to the Juniata shops on account of the need of the Altoona plants for repair work. It is said that only the standard types of engines are to be built next year. No more new work will be done at the Altoona shops this year on account of the present crowded conditions of the plants. The repair work has completely swamped the works.

The car shops will get their schedule of new work within a week. This will include steel cars almost entirely, although some wooden ones of a favorite type are to be built. The Pennsylvania is building comparatively few wooden cars, but the short gondola style is still in favor among the officials, and from 500 to 1,000 of them will be included in the order, along with box cars. All wooden equipment will be built on steel frames. After the summer lapse comes flush times for the men employed in the various shops of the Pennsylvania system. Every department is working full time and many of them have been obliged to work overtime to get out the orders on hand. The motive power department will be one of the busiest on the system during the coming year.

Knows How to Train and Treat Employees.

While on a visit to the Pacific Coast we made the acquaintance of Mr. E. N. Cutting, assistant signal engineer, who was kind enough to explain the working of a school he has established for the instruction and training of the men employed in the signal department. From our talk with Mr. Cutting we recognize him in "Sam Weller," who read a paper at the Pacific Coast Railway Club on "Selecting, Treatment and Training of Employees." Some system of training is well worthy of general imitation, and the method of treatment deserves the greatest praise. We will give our readers more particulars when we are not so short of space as we are this month, when two forms of RAILWAY AND LOCOMOTIVE ENGINEERING are made up and enough mater standing in type to nearly fill another paper.

Mr. Lucius E. Johnson.

Mr. Lucius E. Johnson, general manager of the Norfolk & Western, has been elected president of the road, vice F. J. Kimball, deceased. Mr. Johnson will continue to act as general manager. He began his railroad career as a fireman on the C., B. & Q. Mr. Johnson is another example of a man reaching the highest rank in railroad life through the mechanical department. In 1866 he entered the railway service as a fireman at Aurora, on the Chicago, Burlington & Quincy Railroad. He rose to be engineer, then master mechanic, in which position he displayed so much ability that he was advanced to be superintendent. After filling that position for several years he was in 1890 appointed superintendent of the Montana Central and three years later left there to take a similar position on the Lake Shore & Michigan Southern. In 1899 he was appointed general superintendent of the New York and Western, where he rose to be general manager, and now president. He has earned all the good fortune that has come to him.

MR. L. E. JOHNSON.

The Third Man.

No doubt this "third man" on a locomotive question has been pretty well threshed out; at the same time I ask your indulgence for a few practical questions on the subject. One phase of the third man proposition is newspaper rot, which is on a par with the age limit, and color blindness rot of railroad companies. This third man "behind the gun," will, I suppose, ride on the left side of the engine, and he will no doubt be entitled to a copy of the "orders." Suppose the train is running a system of block or other signals, or runs up against a red light out on the desert, or is following the tail lights of another train, how does this overseer know that the eagle eye of the man on the right side is not taking in the situation, and will act at the proper time? If the third man is nervous, he will be watching the air gauge to notice any reduction at places where he thinks there is danger, and just when the engineer knows everything is all right. By making suggestions and giving advice, he would rattle a good engineer and make him go wrong unintentionally. The writer will wager a year's subscription to LOCOMOTIVE ENGINEERING that the first trip over a busy division, and with the third man on the engine, the train will come in late. One of your correspondents some time ago in speaking of that Jersey Central wreck, said, that no doubt inventors would be equal to the occasion and devise some means to prevent these things. Now I wish to say right here that there is something in use now that will prevent such things. You will find it in your book of rules, and on the back of your time card. The substance of it is never run past a danger signal.

I don't care whether it is a semaphore, red light, flag, or anything waved violently across the track. In nine hundred and ninety-nine cases out of a thousand that railroad man who gets into a hole is the one who takes things for granted. The one crew knowing that the other fellows are late, takes it for granted that they can get out on the main line and do a little switching, and before that switching is ever finished there is a call for the wreck rtain. Why? Well, we did not dream of No. 1 making up so much time, and we thought we would get through with our switching before she came. But what about the widow and children? No. 1 is late, she has a meet up in the canyon, and her engineer takes it for granted that No. 2 will be in to clear. No. 2 is a little late, also, and they take it for granted that No. 1 will slow down, but she don't, and the unexpected happens. When engineers will stop the dangerous practice of running past a flag, without stopping, picking it up, and then proceed with care to the point of obstruction, there will be fewer rear end collisions, and the chances of the third man on the engine being out of a job will be good. Do we want the third man on an engine? Yes. He is wanted on the deck of some of the big mountain climbing coal burners; he is wanted to shovel coal. Now comes the S. P., according to newspaper talk, giving orders for their conductors to spend a part of the trip on the engine; another

phase of the third man proposition. If there is anything an engineer detests, it is to have the "con." riding on the engine; and if the "con." had at one time been a plug puller, it makes matters worse. The proper place for a passenger conductor is in the coaches, taking care of his people. The proper place for a freight conductor when his train is under way is in the caboose, where he can cuss the man with the eagle eye if the train is not making time, from too much tonnage or too little steam, or, if everything is lovely, he might pound his ear, and dream of a nice story to tell in the office, of the fine run I made last night. W. DE SANNO.

San Francisco.

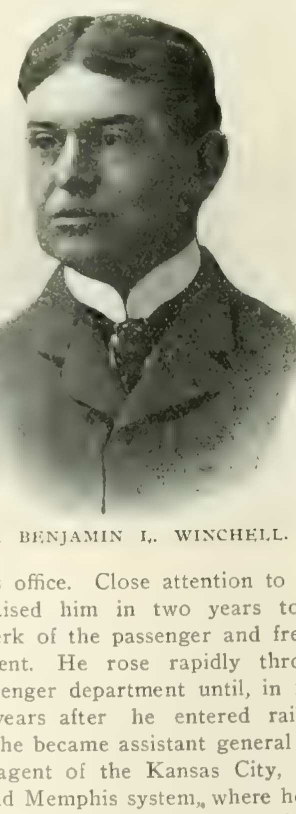
The Names of the States.

Nebraska takes its name from the Indian name of the Platte river, which means "sallow water." Michigan is called from the Indian name of a great lake called Michi-gan. Kansas got its name from Dakota, which means "the south-wind people." The Indian origin of Kentucky means "hunting land," and the Indians called it Kenta-kee. Colorado gets its name from Spanish origin on account of the redness of the rocks of that State. New Mexico is a daughter of Old Mexico, whose early name was Mexitl, a war god. Pennsylvania takes its name from William Penn. New Hampshire is called from Hampshire, England. Montana is of Spanish origin and means mountainous. Missouri takes its name from the Missouri river, which in Indian language means "great muddy." Connecticut derived its name from the Indian word meaning long river, which the Indians called the Connecticut river. Iowa takes its name from the term which the Indians applied to the country beyond the Mississippi, which signifies across. California is of Spanish origin, and was supposed to be a land near the terrestrial paradise. Arizona means arid zone. Massachusetts is an old English word, Massa-wachuset, which means a great hill, and was first applied to a tribe of Indians living near Milton. New Jersey takes its name from the little island of Jersey in the English channel. New York takes her name from James, Duke of York, brother of King Charles I. It was originally called New Netherland.—*Blacksmith and Wheelwright.*

A floating newspaper paragraph tells us that in the Philadelphia and Reading round houses it is a common practice for the boiler makers to enter the fire boxes of locomotives and caulk flues or do other repairs while fire is on the grates. The practice is to smother the top of the fire with fresh coal and put some boards on the top for the workman to rest upon. It is a melancholy practice, but it is followed on many roads, more's the pity. We often wonder if any other kind of machine is so thoroughly abused as the locomotive in the effort to keep it working. The men in charge are not to blame, for irresistible pressure is kept upon them to follow revolting practices that a few hours' extra work per month may be forced out of locomotives.

From Master Mechanic's Office to Third Vice-President.

Mr. Benjamin L. Winchell has been elected third vice-president of the Chicago, Rock Island and Pacific system, and he takes the position of general manager, with headquarters in Chicago, with charge of the whole operation department. Mr. C. H. Warren, first vice-president, will remove to New York. Mr. Winchell did his first railway work in the office of Mr. L. N. Towne, master mechanic of the Hannibal and St. Joseph Railroad, from whence he went into the



MR. BENJAMIN L. WINCHELL.

auditor's office. Close attention to business raised him in two years to be chief clerk of the passenger and freight department. He rose rapidly through the passenger department until, in 1881, twelve years after he entered railway service, he became assistant general passenger agent of the Kansas City, Fort Scott and Memphis system, where he remained thirteen years. General Nettleton, president of the Kansas City, Fort Scott and Memphis developed a high regard for Mr. Winchell, and this influence led to the latter being elected president when General Nettleton died. When the St. Louis and San Francisco absorbed the K. C., F. S. and M., Mr. Winchell was elected vice-president and leaves there to take charge of the operating of the Rock Island system.

Mr. Winchell has been unusually popular in all the positions he has held; his strong points being clear headed energy and fair dealing between man and man. He is said to be highly discrimating in his judgment of men and makes no pretense at knowing the details of work assigned to his subordinates so long as results are satisfactory.

We learn from Mr. Henry F. Colvin, of the Rue Manufacturing Company, Philadelphia, who is remarkably well informed concerning the history of the locomotive, that Seth Wilmarth's locomotives were popularly called "Shanghais," owing to their unusual height, which made them the roosters of the railroad barnyard.

We understand that orders have been issued for reduction of the working force in the various repair shops belonging to the Vanderbilt system of railroads. A movement of that kind generally takes place about this season of the year, but transportation business has been so very active during the last summer that we supposed the cutting down of employees would be omitted.

Young men trying to lift themselves upwards in railway service might profit by the advice lightly given to a son by his mother: He was trying to make a high leap with a bar, but merely accomplished a series of failures. "John," she cried at last, "put your heart in the bar and you will go over."

We spend considerable time obtaining information for correspondents, and in searching for books and articles which they want; but there is a limit to our accommodating spirit. When a correspondent writes asking us to send him a matrimonial paper not named, which contained a certain advertisement we must ask to be excused.

We understand that the historic locomotive "Washington," illustrated in our October number, was run on its famous trial by Fred de Sanno, grandfather of W. de Sanno, who is a frequent correspondent of RAILWAY AND LOCOMOTIVE ENGINEERING. Do any other interested readers have relations who were associated in any way with the building or operating of pioneer locomotives?

The Canadian Northern Railway are building a new round house at Winnipeg, Man. Fifteen stalls will be completed this year, and twenty-six stalls will be added early in 1904. The engine house, of fire-proof construction, will be 80 feet in the clear and will have three entrance tracks. A 70-foot turn table, operated by compressed air, will be put in. This road has received fourteen engines out of an order of twenty-five from the Canadian Locomotive Works in Kingston, Ont. The engines are of the 4-6-0 type.

New Klondyke Railroad.

The *Sun* reported the other day that the first standard gauge railroad in Alaska is now being built. It will extend inland fifty miles, affording transportation when completed to the rich mining camps in the southern part of the Seward Peninsula. The road is to be known as the Council City and Solomon Railroad. It is only the beginning of a system which is to be extended with branches through the Seward Peninsula, making all the great mining centers easily accessible from the sea.

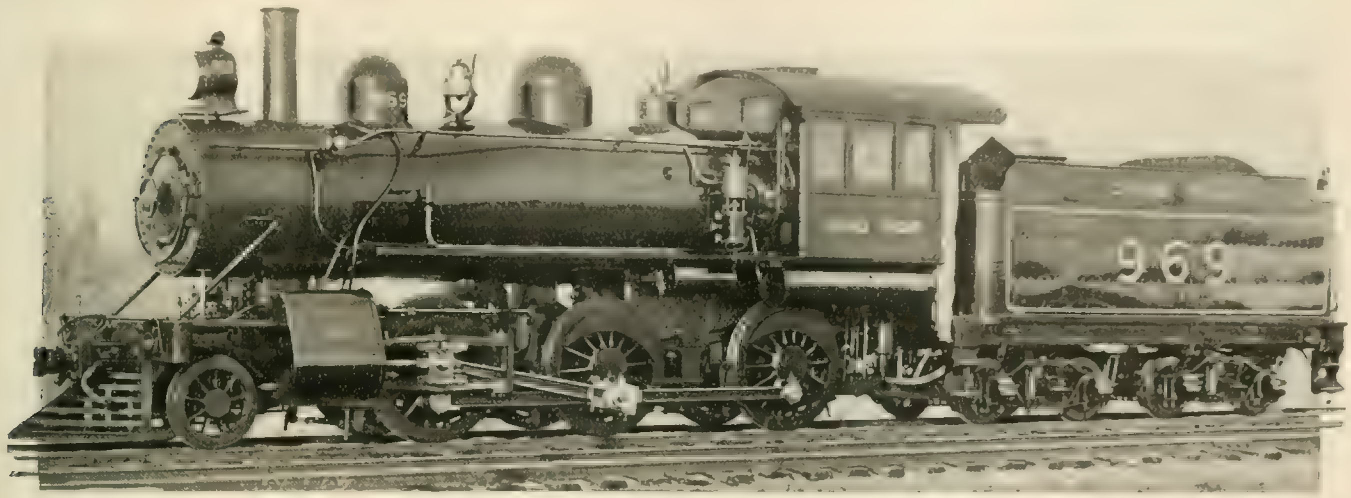
Work on this railroad was begun on June 15, and a force of 500 men is working in day and night shifts. More than ten miles have already been graded and it is expected that two-thirds of the line will be completed this season.

The Seward Peninsula is as yet the great center of gold-mining operations in Alaska. About eleven-twelfths of all the placer gold yielded by Alaskan mining operations last year, or $5,500,000 in all, was obtained from this region, a wide tract of land jutting out into Behring Sea, north of St. Michael's. Nome, at the southwest corner of the peninsula, is still the greatest producer, but mining is in progress on many of the streams and gulches in the interior and last year the other districts contributed a large amount of gold dust to the total output.

The most serious problem has been to transport machinery and supplies into the gold-producing regions, away from the coast. The difficulties of transportation have impeded the development of this wonderful region although great things have been done in spite of this impediment. After heavy machinery has been landed on Nome beach it has been found in a number of cases simply impossible to transport it from the coast to the mines.

The difficulty has been solved, as far as the Anvil Creek region is concerned, for a narrow gauge railroad is now in operation from Nome beach to the head of Anvil Creek, a few miles in the interior. Good wagon roads have also been built from this railroad to adjacent creeks, so that it is now possible to handle heavy machinery for the region tributary to Nome; and the fact that the railroad now rapidly pushing forward is expected to solve the problem for the more isolated camps gives the enterprise its great significance.

The first districts to benefit by the new railroad will be the Solomon River region and the camps on Ophir Creek north of the southeast coast of the peninsula. The railroad will push right through these regions. It will start from Council City in the southeast and extend to the northwest and north. How important the road will be for these great mining camps will be appreciated when the fact is mentioned that in spite of the present difficulties of transportation, the output of Ophir Creek last year was more than $1,000,000 of gold dust.



COMPOUND MOGUL—GRAND TRUNK RAILWAY SYSTEM.

Cross Compound Mogul.

Through the courtesy of Mr. W. D. Robb, superintendent of motive power of the Grand Trunk Railway, we are enabled to present to our readers a very good example of freight power which has been built in the Point St. Charles shops of the Grand Trunk system.

The engine is a mogul, or 2-6-0 engine, as will be seen from the illustration, and is a cross compound of the "Richmond" type. The cylinders are 22½ and 35x36 ins. and the driving wheels are 63 ins. in diameter. The valves are piston on some of this class and slide on others, and the usual indirect motion is used. The springs are all underhung and the main driver is is the only pair of wheels without flanges. The adhesive weight is about 140,744 lbs., while the total weight of the machine is 163,704 lbs. The weight of the tender is about 130,856 lbs., thus giving a total weight in working order of 294,560 lbs. Our illustration shows the small high stack supported on the pressed steel base which is standard on the Grand Trunk.

Weather-Proof Windows.

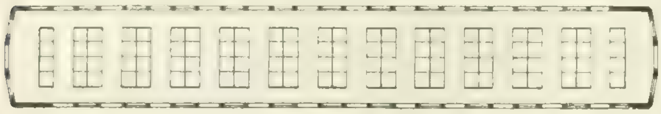
We have received from Mr. R. E. Allison, a locomotive engineer on the Grand Trunk Railway, a copy of a circular he has issued in connection with the Allison weather-proof window. This window is, among other things, for use in locomotive cabs and is designed to prevent the formation of frost on the pane and also to prevent the lodgment of snow. This is accomplished by providing two panes set in a suitable frame, with an air space between them. Below this frame in a casing is a series of steam heating pipes. The air which is heated by these pipes rises between the panes and prevents the formation of frost and melts any snow that may be driven against the outer pane. Tubes are provided on each side of the air space whereby the air which as become slightly cooled by contact with the glass, is conducted down into a space below the heating chamber. Suitable inlet and outlet valves for air and steam are provided, and when once warmed up, the hot pipes keep up a circulation of warm air between the panes.

Mr. Allison's address is Lindsay, in the Province of Ontario, Canada. He is prepared to grant licenses for the use of his window.

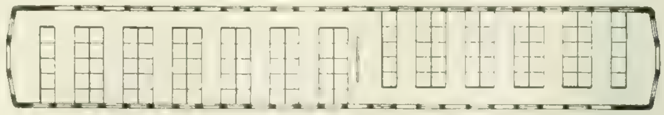
Our facetious friend, Mr. H. H. Vreeland, president of the Metropolitan Railway System, visited Europe last summer and he gives some funny descriptions of what he saw abroad. He says as to speed of trains in Europe, it is about the same as ours here, although he said he had traveled 700 miles on the "Oriental Express" at the rate of eighty miles an hour—fifty miles straight away, twenty miles up and down, and ten miles sideways."

Steel-Frame, Side-Door, Passenger Car on the Illinois Central.

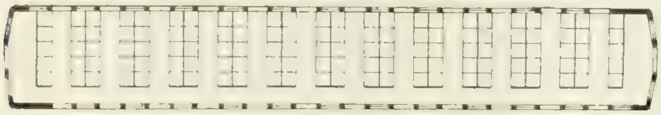
In the July issue of RAILWAY AND LOCOMOTIVE ENGINEERING (page 333) we gave a brief account of the steel-frame, side-door passenger car, built by the



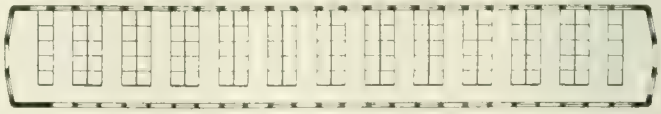
PLAN NO. 1.



PLAN NO. 2.



PLAN NO. 3. DOORS BOTH SIDES.



PLAN NO 4. DOORS ONE SIDE.

Illinois Central Railroad for suburban service.

This new type of car is the result of careful study based upon long experience

NEW SIDE-DOOR, STEEL-FRAME SUBURBAN CAR, I. C. R.

in the handling of a large suburban traffic on the part of Mr. A. W. Sulivan, assistant second vice-president, and of Mr. William Renshaw, superintendent of machinery of the Illinois Central.

The underframe of the car consists of four 9 ins. by 21 lbs. steel I-beams, 64 ft. in length, spaced nearly equal distances apart and of a total width over the flanges of 10 ft. 4 ins. The end sills are 9 ins. by 25 lbs. steel channels, set with backs to the squared ends of the longitudinal sills and riveted to them with double angle plates reinforced by gussets. Four truss rods passing over the inner body bolsters and anchored to the outer body bolsters, are used to support the middle of the car. These rods are solid, that is, without the usual swivel connection in the middle; their adjustments being obtained by eight vertical screw queen-posts resting with their lower ends upon the rods and their upper ends supporting two steel needle beams of 7 ins. by 15 lbs. I-beams extending entirely across the car under the sills, with their upper flanges riveted to the lower flanges of the sills, thus bracing as well as supporting the under-frame.

Over the body bolsters and over the needle beams, 6 by 12¼ ins. I-beams in short sections are placed between the longitudinal sills as stiffening members and riveted with angles to the webs of the sills.

Upon the metal sills, a steel floor of ¼ in. plates, 60 inches in width, is laid with butt joints formed by the planed edges of the plates and extending entirely across the underframe. This floor is riveted to the upper flanges of the sills with double rows of ½ in. rivets. There is thus obtained a continuous metal surface extending the entire length and width of the car, insuring perfect rigidity of the underframe and giving complete protection from fire underneath the car. In addition to this, a layer of asbestos ¼ in. thick is placed on the plate floor, and on the asbestos a maple floor is laid.

The underframe is carried upon four body bolsters made of 7 by 1 in. steel bars in the upper and lower members. The bolsters are arranged in pairs, 4½ ft. centers, and bolted to the lower flanges of the sills. Heavy truss connections extend between the bolsters, to which are bolted the center plates.

The corner posts consist of two 4 by 5, ¼-in. channels set transversely on the side sills and spaced 11 ins. apart. On the outside and inside of these posts four triangular gussets of ¼ in. by 15 ½-in. steel plate are riveted to the flanges, tying them firmly together; the corner posts are riveted securely to the side sills and to the upper plates with angle connections. The space between the corner posts and the adjoining side-door posts is braced with a double set of diagonal bracing, formed of 1 ¼-in. angles in three vertical panels and riveted to the gusset connections. This arrangement of corner bracing gives stability to the upper frame and forms a collision bulkhead of great resistance.

The utilization of floor space for seating accommodation has been referred to in a previous issue. There are four plans, any one of which is vastly superior to the one formerly used. The old I. C. R. suburban car

SIDE-DOOR TRAIN—METROPOLITAN DISTRICT RAILWAY, LONDON.

seated 56 people, plan No. 1 seats 96; plan No. 2 seats 115, and plan Nos. 3 and 4 seats 120 people. The time required to fill or empty the car, or for that matter, the entire train, is no longer than that

for any one pair of cross seats to be vacated and re-occupied. With the use of side-door cars of this description people do not stand together in groups on the platform, and the crowding and surging incident to the end door car is thus avoided.

We are indebted to Mr. Sulivan for the information here presented.

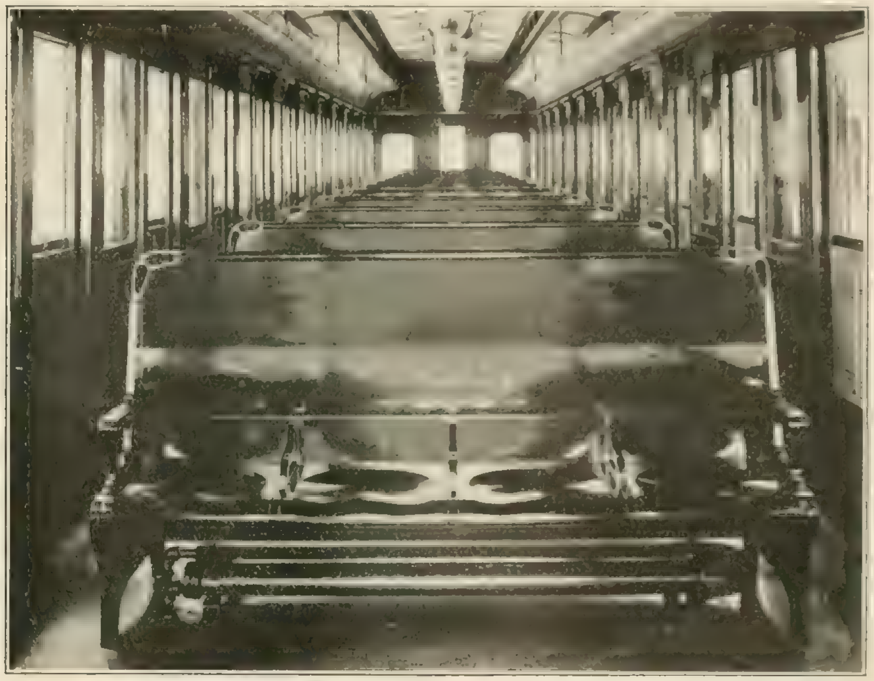
"Words, Words, Words."

When that obsequious old court functionary Polonius approached Hamlet with the question, "What do you read, my lord?" he was met with the sententious reply, "Words, words, words." This rejoinder was almost in strict accord with the scriptural injunction to "answer a fool according to his folly." It was, however, not only intended to perplex Polonius, but was intended to strengthen the prevalent opinion concerning the young prince of Denmark, viz: that he was mad.

Now, it is quite true that if Hamlet was reading the book he had in his hand when Polonius addressed him, he certainly read words, words, words, and many of them, too. That was, however, merely a somewhat witty reply which Shakespeare permitted him to make to the tedious old man. The real meaning of reading is not simply to con over the words used, but to get hold of the subject matter presented, to understand it and to grasp the author's meaning. In other phrase, the reading of a book or a magazine is beneficial if it enables one to get hold of other people's ideas. We have often urged our club raisers to point out that very advantage to prospective subscribers of our magazine, and it is true not only of our own readers, but it is true of the readers of good, reliable books on technical subjects—they get hold of other people's ideas, which is the important thing nowadays.

Look over the list we give here and see if some of the books will interest you. You will get the "words" which Hamlet humorously spoke of, but you will also find them backed up by good ideas and thoughts.

The first on the list is, of course, RAILWAY AND LOCOMOTIVE ENGINEERING, a practical journal of railway motive power and rolling stock. It costs only $2.00 a year, and is well worth the money, and besides the paper is a welcome visitor in every household. Let your wife and children see it.



INTERIOR OF ILLINOIS CENTRAL SUBURBAN CAR.

"Locomotive Engine Running and Management," by Angus Sinclair, is an old and universal favorite. A well-known general manager remarked in a meeting of railroad men lately, "I attribute much of my success in life to the inspiration of that book. It was my pocket companion for years." We sell it for $2.00.

"Practical Shop Talks." Colvin. This is a very helpful book, combining instruction with amusement. It is a particularly useful book to the young mechanic. It has a stimulating effect in inducing him to study his business. The price is 50 cents.

"Examination Questions for Promotion." Thompson. This book is used by many master mechanics and traveling engineers in the examination of firemen

for promotion and of engineers likely to be hired. It contains in small compass a large amount of information about the locomotive. Convenient pocket size. We cordially recommend this book. The price is 75 cents.

"Compound Locomotives." Colvin. This book instructs a man so that he will understand the construction and operation of a compound locomotive as well as he now understands a simple engine. Tells all about running, breakdowns and repairs. Convenient pocket size, bound in leather, $1.00.

"Catechism of the Steam Plant." Hemenway. Contains information that will enable a man to take out a license to run a stationary engine. Tells about boilers, heating surface, horse power, condensors, feed water heaters, air pumps, engines, strength of boilers, testing boiler performances, etc., etc. This is only a partial list of its contents. It is in the question and answer style. 128 pages. Pocket size. 50 cents.

"Care and Management of Locomotive Boilers." Raps. This is a book that ought to be in the hands of every person who is in any way interested in keeping boilers in safe working order. Written by a foreman boilermaker. Also contains several chapters on oil-burning locomotives. Price, 50 cents.

"Locomotive Link Motion." Halsey. Any person who gives a little study to this book ceases to find link motion a puzzle. Explains about valves and valve motion in plain language, easily understood. Price, $1.00.

"Machine Shop Arithmetic." Colvin and Cheney. This is a book that no person engaged in mechanical occupations can afford to do without. Enables any workman to figure out all the shop and machine problems which are so puzzling for want of a little knowledge. We sell it for 50 cents.

"Firing Locomotives." Sinclair. Treats in an easy way the principles of combustion. While treating on the chemistry of heat and combustion it is easily understood by every intelligent fireman. The price is 50 cents.

"Air-Brake Catechism." Conger. Nothing better can be found for persons trying to learn all about air brakes. Tells the whole story. We sell it. Cloth, 75 cents. Leather, $1.00.

"Skeevers' Object Lessons." Hill. A collection of the famous object lesson stories which appeared in this paper several years ago. They are interesting, laughable and best of all they are of practical value to-day. $1.00.

"Stories of the Railroad." Hill. Best railroad stories ever written. Those who have not read these stories have missed a great literary treat. $1.50.

"Standard Train Rules." This is the code of Train Rules prepared by the American Railway Association, for the operating of all trains on single or double track. Used by nearly all railroads. Study of this book would prevent many collisions. Price, 50 cents.

"Mechanical Engineers' Pocket Book." Kent. This book contains 1,100 pages 6x3¼ inches of closely-printed minion type, containing mechanical engineering matter. It ought to be in the bookcase of every engineer who takes an interest in engineering questions. We use it constantly as a reference for questions sent to us to be answered. Full of tables and illustrations. Morocco leather, $5.00.

"Locomotives, Simple, Compound and Electric." Reagan. An excellent book for people interested in any kind of locomotive. It will be found particularly useful to men handling or repairing compound locomotives. It is the real locomotive up to date. $2.50.

Railway and Locomotive Engineering. Bound volumes. $3.00.

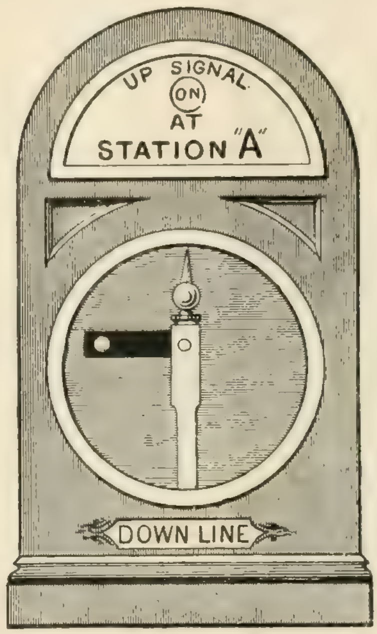
The latest catalogue of the Tabor Manufacturing Company, of Philadelphia, has been received. It is artistically printed and sets forth the merits of the Tabor Vibrator Molding Machines. The pamphlet opens with an introduction which deals with machine moulding. Vibrator moulding is explained and the materials used are mentioned. Matches, paraffined wood plates and sprue cutters are then taken up. Aluminum as a pattern material is discussed, and the advantages of its use are explained. Split pattern vibrator machines, and their operation, are well illustrated by half-tone and letter press. Vibrator frame machines are also described and the action of vibrators is set forth, also that of automatic stripping-plate machines. A list of stock sizes of power ramming split pattern machines with vibrators is given, also those of vibrator frame machines, and power ramming single or duplex automatic stripping-plate machines. The concluding pages contain half-tone illustrations of parts, numbered and named, to facilitate ordering. The Tabor Company will be happy to send a copy of the catalogue to anyone interested enough to write for one.

The report of the proceedings of the thirty-sixth annual convention of the American Railway Master Mechanics' Association has just come from the press. It is bound in half leather and is therefore uniform with those of the printed records of former years. This volume, which covers the Saratoga convention held on June 24, 25 and 26, 1903, contains 457 pages of reading matter as well as numerous tables, illustrations and data belonging to the reports; and in the recommended practice of the association. The book, price $1.50, makes a valuable volume, and may be obtained from the secretary, Mr. Joseph W. Taylor, the Rookery Building, Chicago.

Signals and Signaling.

(Continued from page 518.)

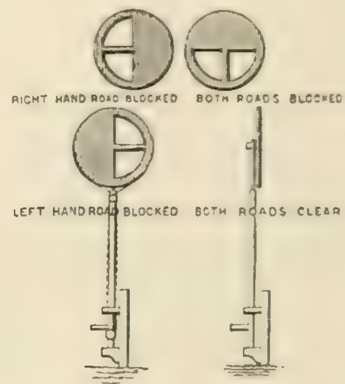
David's station, with a steep grade between the two places. Mr. W. H. Preece invented a new form of instrument which did much to popularize block signaling. Realizing that the difficulty of teaching operators the method of working signal instruments had delayed the general adoption of the block system, Mr. Preece produced an instrument in which a small lever was used to actuate a miniature semaphore, so that the work of transmitting a signal to the next station ahead was similar in form at least to the work performed when the large semaphore out of doors was being operated. With the electric signal on the operator's table, simply a repetition on a small scale, of the full-sized line signal, the apparent complication of the signal instrument disappeared, and the whole matter



PREECE'S INSTRUMENT.

was rendered perfectly intelligible to pointsmen, signalmen and operators alike. A further improvement was also noticeable in this instrument. Heretofore the man sending the signal could not tell whether or not the instrument at the receiving station showed the correct indication. In other words, an instrument out of order at the distant station would be difficult of detection. Mr Preece's device was so arranged that the operator at A sending a "Line Clear" indication to B, would not only see his own miniature semaphore arm drop, but would hear a bell ring on his instrument if the arm on the miniature semaphore at B had been lowered at the same time as his own. In 1866 Mr. Preece introduced his single wire system. It was further improved in 1872, and in order to obviate disturbances produced on a single wire system by lightning or by the crossing of wires, he arranged his instrument so that the "all clear" signal could only be produced by the concurrent action of operators at both ends of the section.

The first use made of the block signal principle in this country was made on the Camden & Amboy Railroad in 1865. The signal then used was practically a square box with clear glass on two faces, and a lamp in the center. Red, green and white flannel banners or screens were drawn into the field of view as occasion required, and at night the light shone through these screens and gave the appropriate indication. In 1873, after this road had become part of the Pennsylvania, this signal was modified, as it was found that the reflection of the sun from the glass sometimes obscured the screen. It was therefore arranged that when the red color was shown in the case, an arm would be extended from the box bearing a red disc, and when the green color was displayed in the case, a green clover leaf at the end of an arm was extended from the box. The first signal



REVOLVING DISC SIGNAL.

depended upon color alone to give the correct indication. The improved signal not only had a color indication, but one depending upon position as well. In 1883 the semaphore block signal was introduced as the one which was still more reliable, in that it depended upon position alone. In 1886 the semaphore for switch signals was installed. The Pennsylvania Railroad was thus the pioneer road in the United States to introduce block and interlocking signals.

In America the first automatic signal system was the original Hall, which was used in the States of Massachusetts and Connecticut about 1871; it was then operated by wires carried on telegraph poles. In 1879 the track circuit, which dispenses with wires and poles, was introduced by the Union Signal Company and used on the Fitchburg. The Pennsylvania installed an interlocking plant, made by the English firm of Saxby & Farmer in 1875. They used the Toucey and Buchanan signal in 1877, the semaphore flag station signal in 1885, the pneumatic interlocking in 1891, and in

1802 the automatic pneumatic block signal.

Signals and signaling on a railway are simply precautionary devices and methods for securing safety in train operation. The principal aims to which all railway signaling and interlocking should be directed are, that the right road for a given train should be prepared, that is, all switches and derails on the line should be closed so as to make the rails continuous for that train. That having properly "made" the road it should be secured by operating suitable locking devices. That only after the road has been made and locked, the correct signal be given. That the correct signal be the only one that can be given. After the road has been made, locked and signaled, that a certain amount of time must be required to elapse before any alteration is possible in signals or road. Lastly in blocking, that the required space interval be preserved faithfully and any failure of the apparatus shall indicate "danger," and though it causes a delay, it shall never permit disaster.

Mr. Dorsey, an American engineer, when writing some years ago on "English and American Railroads Compared," said of the block signal system, which has been compulsory on all railroads in Great Britain since 1889: "It is astonishing to see the blind faith the English engine driver places in his block signals. In dense fogs, when he cannot see 100 feet ahead, or dark nights, when his vision is also very limited; for his headlight in only an ordinary lantern, useless for illuminating the track, and only used as a signal; or, frequently when he has dark night and dense fog to run through, yet he runs at full speed, and generally on schedule time, feeling sure that he is perfectly safe, because his block signals have told him so, and they cannot make a mistake or lie."

(*To be Continued.*)

The J. A. Fay & Egan Company of Cincinnati.

We recently had the pleasure of visiting the manufacturing establishment of the J. A. Fay & Egan Co., of Cincinnati, Ohio. The shops are located in a busy portion of the "Queen City," and comprise in all fifteen acres of floor space, over which are spread 1,200 employees. The output of this large concern is 8,000 machines per year, and it is made up of every known kind of wood-working machine.

An old-time vaudeville joke was for the entertainer to announce that a genius had been discovered in the West, who was able to cut wood without using a saw or an ax—he did it with a hatchet! A glance through this establishment would show that the modern way is to use a Fay & Egan machine and cut it quickly and accurately. This firm makes wood cutting appliances for everybody who uses machinery to cut wood from the smallest pattern shop up to the large railway and the government navy yard. It is not only within the borders of the United States that the Fay & Egan machines may be found, fully half their business is an export one, and their wares are to be found in all the manufacturing countries of the world.

They have recently got out an extensive line of wood-working machinery especially adapted to use in railroad shops, besides the general run of tools for miscellaneous wood using shops. In fact, an entire factory could be equipped by this firm, and a tool or tools supplied for every wood-working operation which the factory might need. This is something which it would probably be impossible to parallel anywhere in the United States. They are very busy at present but are fully equal to cope with this or a larger demand for first-class wood-working machinery.

This well known company is 73 years old and has had a continuous growth since it started in 1830 at Keene, N. H. The consolidation of the J. A. Fay & Egan Co. took place in 1893, and it has felt the beneficial effects of the amalgamation ever since. The J. A. Fay Co. and the Egan Co. were healthy rival concerns in the beginning and gave each other a great deal of trouble in the matter of law suits, etc., over patents, until the "merger" put an end to their disputes. The new company showed much business sagacity in retaining in its service brainy men from each of the original companies and in selecting the best machine made by either firm as the standard one in its particular line to manufacture for sale, and to improve upon as time went on.

The J. A. Fay & Egan Co. have been uniformly successful in securing recognition wherever their machines have been exhibited. Beginning with the first international exhibition, the famous Crystal Palace Exhibition in London, in 1851, down to the present time, they have taken medals at all "World's Fairs." They have been awarded the Grand Prix in Paris in 1878, 1889 and 1900. Two decorations of the Legion of Honor have been conferred by the French government upon members of the company, one upon a former president and one upon Mr. Thomas B. Egan, the present president.

Robert H. Thurston, the celebrated mechanical engineer, dean of Sibley College of Engineering in Cornell University, died suddenly on October 25 on his 64th birthday. Professor Thurston was long connected with the Stevens Institute of Technology and was a voluminous writer on engineering subjects, his History of the Growth of the Steam Engine being the most popular of his works. He served as an engineer in the United States Navy during the civil war and made an enviable record.

The B. F. Sturtevant Company's New Foundry and Pattern Department at Hyde Park, Mass.

The new plant erected by the B. F. Sturtevant Company, of Hyde Park, Mass., comprises a commodious four-story office building 45x125 ft., a three-story building 80x500 ft., devoted to the manufacture of blowers, heaters and galvanized iron work; a building 80x250 ft. used for testing engines and for electrical equipment. The general machine shop measures 120x500 ft., with 40 ft. side galleries, devoted principally to the building of engines, a forge shop 40x100 ft., a two-story building of the same floor area set apart entirely for lockers, washing and sanitary facilities for the employees, a pattern storage building 80x150 ft., a foundry 170x350 ft., and a power house 80 ft. square. The aggregate floor area of these buildings exceeds nine acres. The arrangement of the buildings is the result of the most careful study and endeavor to simplify the matter of inter-transportation.

WORKS OF THE B. F. STURTEVANT COMPANY, HYDE PARK, MASS.

The flask-shop, 60x80 ft., is equipped with band, crosscut and splitting saws, boring machine and lathe, all driven by a 10 h.p. Sturtevant motor suspended from the ceiling. Immediately above is the pattern shop, abundantly lighted upon three sides and equipped with a full compliment of tools. In the pattern storage, around the pipe columns which support the floors, are clamped the pattern shelving brackets, which are adjustable to any height. The first floor is concrete and is designed for the keeping of heavy cast iron patterns. The foundry consists essentially of two long craneways each 35 ft. in width, with center bent of the same width and side floors 30 ft. wide. The craneways are designed for 20-ton electric traveling cranes. Brick division walls 3½ ft. high, running lengthwise of the foundry, separate the floors on the lines of the columns. Lighting is secured through monitors in both of the craneways and through ample side windows. In the center line the craneway, and in the bent between them runs an industrial railway with turn tables connecting with the cross aisles, which provides for the [illegible] metal, etc.

An ingenious system of charging has [illegible] pass at floor level in front of the bins. They are there loaded, weighed and passed to the elevator for the charging floor. As each car is unloaded it is pushed forward and started down an incline on which it runs, but in an opposite direction to that taken when coming up. A novel apparatus gradually stops the car, and releases it so that it may roll on to the elevator, which is automatically tripped and descends to the ground floor.

The two cupolas are 56 and 72 ins. in diameter respectively. The eminent adaptability of the Sturtevant pressure blower is here exhibited in a marked manner. Two blowers, Nos. 8 and 10, driven by a 30 and a 40 h.p. Sturtevant belted motor, are supported on the charging platform through which they discharge directly downward and thence to the cupolas.

The entire transportation equipment of the plant, including tracks, cars, trucks, etc., was designed and built by the Sturtevant Company. The cars are provided with a special type of ball bearings having chilled wearing surfaces.

The brass foundry, located in a corner of the main building, is provided with crucible furnaces, and a special form of reverberatory furnace designed principally for melting babbitt and similar soft metals. In the middle of the end of the foundry is the core room. The ovens are six in number, three being 7 ft. diameter of the reel type, and three being respectively 4, 5 and 7 ft. in width by 8 ft. 10 ins. long, provided with cars. At the other end of the foundry is the cleaning room, adjacent to this is the pickel room, both floors laid with concrete. Provision has been made for sanitary arrangements all through, but this equipment is most generous in case of the foundry, which has a large locker and wash room.

Naturally the entire plant is heated and ventilated by the Sturtevant system. Dis-

tribution of air is made through a system of overhead galvanized iron piping discharging downward to the floor. A complete underground tunnel system is provided for the distribution of steam, electricity, compressed air, etc., and return of condensation.

Frank Brackett's Models.

Mr. Frank Brackett, round house foreman of the B. & M., at Nashua, N. H., and a thorough mechanic as well, has favored us with several photos of working models of which the above are reproductions. These models are used by him in illustrating the valve motion of slide and piston valves, their diseases and remedies. They are of his own design and construction and he has spent a great deal of time and money on them. He uses air taken from the train line of an engine as the motive power. Fig. 1 is a complete engine for this purpose, and Fig. 2 a sectional view of the slide and piston valve and the 9½ in. pump. His instructions, which are free to B. & M. enginemen, are much appreciated.

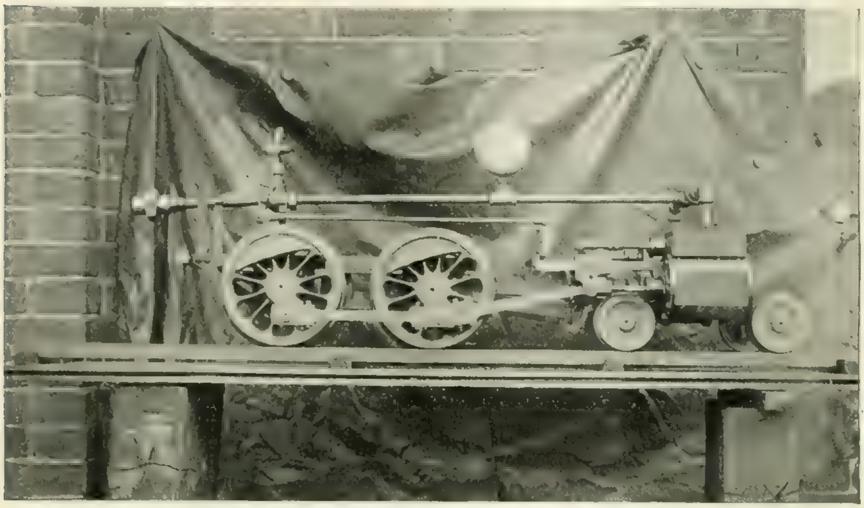


FIG. 1. MODEL ENGINE OPERATED BY AIR.

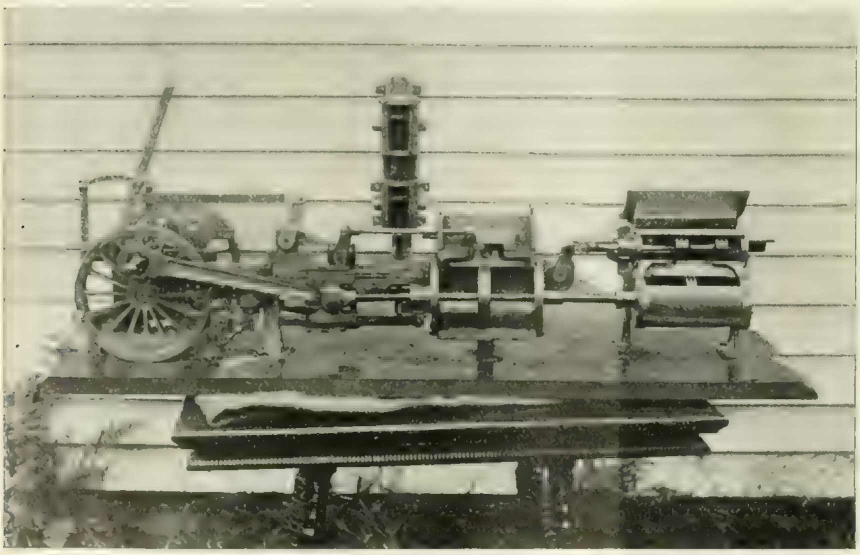


FIG. 2. SECTIONAL MODEL OF SLIDE AND PISTON VALVES.

Mr. George F. Tinkham, for a number of years the engineer of the Upson Nut Company, has, through native skill and knowledge gained by correspondence study, invented and patented a Hydro-Carbon device for increasing the efficiency of a brick furnace. It was decided to determine by test the merits of his invention. Two of the seven boilers of the plant were fitted with this device and the others used mechanical stokers.

Mr. Tinkham wrote to the American School of Correspondence, who suggested Mr. Carl S. Dow, chief of the Department of Mechanical Engineering, as a man best fitted to give an impartial judgment in the matter. Upon this request Mr. Dow made the test. By means of this device steam is taken from the boiler and conducted through the fire-brick setting to the furnace. It

is claimed by the inventor that the steam is superheated and then broken up into its elements, hydrogen and oxygen. This superheating is accomplished by the intense heat of the incandescent firebrick and by flowing from a $\frac{3}{4}$ in. pipe through small holes $\frac{5}{32}$ in. in diameter.

According to his own statement, Mr. Tinkham owes nearly all his knowledge of the theory of engineering to his course with the American School of Correspondence, his boyhood schooling ending when he was eleven years old, having no other training but practical experience until he took up correspondence work at the age of forty-five.

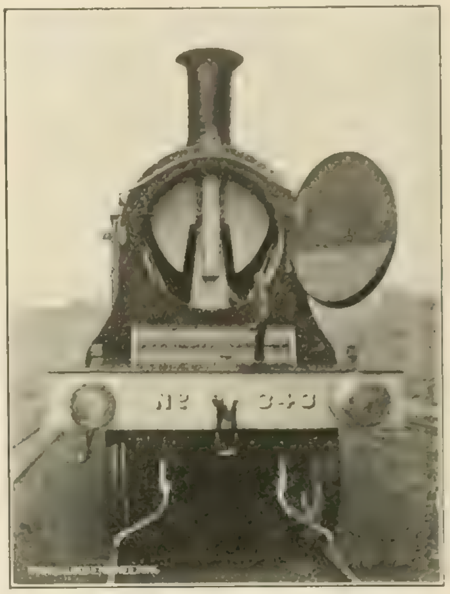
The publication called *Graphite* is issued by the Joseph Dixon Crucible Company, of Jersey City, N. J., in the interest of their productions. The October number is a very interesting issue, larger than usual, as it contains something unique. The president of the company having photographs of nearly all of the staff of superintendents and salesmen in his employ, sent them to the well known phrenologists, Fowler and Wells, of New York, with a request for a "reading" of character of each. The names of the men were not given to the "bump readers," each photograph having a number only. The "readings" thus obtained were so highly gratifying to President E. F. C. Young that he had both photographs and readings reproduced in the October *Graphite*. Twenty-three names appear, including that of Joseph Dixon, who founded the company in 1827. This issue of the Dixon paper will form a very interesting study for persons who desire to acquire the faculty of judging their fellow men by their faces, or who would like to do a little amateur "observing" of the Sherlock Holmes order. Write to the Dixon company; the paper can be had for the asking.

The Pratt & Whitney Company, of Hartford, Conn., have issued a catalogue of small tools made by them. The subtitle of the catalogue is "standards and gauges." In the opening pages are illustrations, formulas and dimensions of screw threads—the U. S. Standard, the metric system, the sharp V-thread, the Acme standard, the Whitworth, and the British Association standard threads. The various taps, hobs, adjustable and plain dies, chasers, hollow mills, dies, milling cutters, reamers, counter bores, drills, straight edges, punches, gauges, etc., are all catalogued and arranged with illustration, description and price. An index at the end of the book enables the reader to quickly find what he may be looking for. The catalogue is about 7x4½ and is a good specimen of the printer's art.

An English Spark Arrester.

One of the fortunate conditions of locomotive operating enjoyed by locomotive officials in the British Isles, has been that they were not required to wrestle with spark arresters. American locomotive people had good reason to envy their foreign friends of exemption from one of the most troublesome tasks in caring for locomotives.

It appears that this exemption is to be no longer enjoyed. Mr. Dugald Drummond, the able chief mechanical engineer, of the London and South-Western Railway, has invented a spark arrester, shown in the annexed engraving, and has applied it to all the engines belonging to the South-Western system. It has also been applied to the express engines of the Highland Railway, and will, no doubt, force its way upon all British



railways through the legal requirement that railways, to escape fire claims, must employ the best practicable means for preventing spark throwing by locomotives.

The Drummond spark arrester consists of a divided diaphragm plate secured to the top of the exhaust pipe and extending from above the upper row of tubes two-thirds of the way towards the bottom of the smoke box. No netting is employed and the diaphragm appears to act as a cleaner of the smoke box from cinders.

A representative of the *Locomotive Magazine*, from which we copy the illustration, investigated the action of the spark arrester, and concluded that it improved the steaming of the engine. This would be due to the draft through all rows of tubes being equalized by the diaphragm plate.

The engines have Mr. Drummond's arrangement of water tubes in the fire box which act as a partial spark arrester themselves.

The Ingersoll-Sergeant Drill Company, of New York, has ordered six gondola cars, of 100,000 pounds capacity, from the Pressed Steel Car Company, Pittsburgh, Pa. These cars are to be 40 ft. over end sills and 9 ft. 10 ins. over side stakes, and will be equipped with Kelso steel couplers 5x7 ins., wooden drop ends, Westinghouse draft rigging, pressed steel brake beams, arch bar trucks, gray iron journal boxes, M. C. B. journal bearings and wedges, 700 pound wheels and pressed steel bolsters.

Section 3 of the Catalogue of Interlocking and Signaling devices, got out by the Union Switch and Signal Company, of Swissvale, Pa., has just been issued. This number is devoted to mechanical locking and operating devices, and with an index it covers 132 pages. The book is uniform with the other catalogues of this company, and it is needless to say that it is fully up to the high standard of excellence which has always been maintained. The line cuts are very clearly drawn and plainly numbered, with name of part and price on the opposite page. The half-tones are equally good, and all being printed on heavy white paper makes a very satisfactory showing. It is, of course, intended primarily for use in ordering parts, but a good idea of the locking and operating devices may be obtained by a glance through its pages.

Mr. A. O. Norton, of 286 Congress street, Boston, Mass., and Coaticoke, Que., Canada, has issued a little folder in which he reminds his friends that the making of jacks is his only business, and he therefore claims to know a good deal about jacks. Years of experience, labor-saving machinery, and first-class material go to make up the "Norton" jack.

Those using the Imperial Pneumatic Hammers, made by the Rand Drill Company, 128 Broadway, New York, speak in the highest terms of the convenience and durability of the tools. They are considered particularly good tools for boiler work, and are popular with the men using them, which is a very good sign. Foremen boiler makers, general foremen and others directly interested in having good working tools should send for the illustrated catalogue of these pneumatic tools.

H. K. Porter & Co., of Pittsburgh, Pa., has been awarded the contract for a sixteen-ton locomotive to be used by the government in the construction work at the south pier of Superior entry. This will be the second locomotive furnished by the Pittsburgh concern, and it will cost $2,750.

CONTENTS.

Railway and Locomotive Engineering

Copyright by Angus Sinclair Co.—1903

A Practical Journal of Railway Motive Power and Rolling Stock

Vol. XVI. 174 Broadway, New York, December, 1903 No. 12

Scenes in Alaska.

The recent decision of the controversy between the United States and Canada concerning boundaries in Alaska, has excited unusual interest in the region which bears that name. We therefore consider it seasonable to publish some pictures of Alaska which have been waiting in this office for months. The views of Skagway and the neighborhood possess unusual interest, since that is territory which Canada claimed and which the Alaskan Boundary Commission decided belonged to the United States. The railway scenes shown indicate that Alaska is a hard road for railroads to find location.

Alaska was purchased from Russia by the United States in 1867 for $7,200,000. People generally considered that Uncle Sam made a poor bargain, until gold was discovered in the territory about ten years ago, which changed conditions amazingly and moved Canada to stretch forth a searching hand for territory that nobody had previously displayed any interest in.

This part of the American coast was "discovered" in 1741 by a Russian expedition under Admiral Bering, who gave his name to the straits between America and Asia. The discovery was like that of a Scots toper who wandered in his cups to the top of a hill and went to sleep. In the morning he awoke and saw his peaceful native village reposing in the valley. After looking at the place for a few minutes without recognizing it he exclaimed: "I've found a toon that naebody kens aboot." Then he sallied forth to take possession, but was kicked out by the constable.

Bering was no more modest. Like the spoils politician he claimed everything in sight and much beyond the vision of his crew, even along to the coast of Mexico. Bering's enterprise gave Russia the excuse for sending some officials to rule Alaska, but it did nothing to develop the country, for in 1880 there were less than 500 white men in the territory. The gold fever, however, soon swelled that type of population, and it is estimated that there are now about 60,000 whites in Alaska.

ROTARY SNOW SHOVEL AT WORK IN ALASKA

The following article taken from the *New York Tribune* gives a good picture of the existing conditions in Alaska:

Any one who has visited the part of Alaska that has been in dispute has soon

discovered that it was characteristically American. Here he found only another form of the same Americanism which penetrated the wilderness of the prairie of the United States a half century ago and built cities where the buffalo roamed.

there would be a fight. A squad of mounted Canadian police moved their headquarters to White Pass, within the disputed territory, and raised the British flag. As soon as the news reached Skagway a crowd of men gathered as rapidly as they do in Kentucky when the law is

SNOWBOUND IN ALASKA

"too slow," and as soon as their horses could reach White Pass the British flag was torn down and the Stars and Stripes floated in its place. Then the police hoisted another British flag, and again a posse of Skagway citizens started out to pull it down. There might have been blood spilled had not prominent Americans interfered. At last the Skagwayans went to a higher peak and unfurled a still larger American flag. The two emblems of empire floated there all summer undisturbed.

In Skagway, at the head of the Lynn Canal, and now the metropolis of this district, there are even tokens of the civilization of far away New York. There is another Broadway, and although not walled up with skyscraping office buildings nor perforated with a subway, yet in Skagway, as in Manhattan, Broadway is Broadway.

When the thick gold streaks of the Atlin district were discovered, just over the border line, the wideawake citizens of Skagway were the first to pounce down on them. They hustled across White Pass and staked out the best claims. After a time came the Canadian officials, with the demand that the American miners should become Canadian citizens. There was hardly a man who did not refuse.

"The flag is better than gold," was a saying which was heard on every hand. So most of the miners went back to Skagway and sought to make their fortunes in various lines of trade and manufacture. But soon there was another bit of news which frightened the more timorous.

"Canada is After Skagway," was the headline of one weekly newspaper's article, and it went on to say that the Dominion had revived its old claim to this territory. The sister town of Dyea also took alarm, for it, too, was within the disputed territory. A few emigrated to where the Stars and Stripes floated without danger of being supplanted by the Union Jack. But the majority simply waited for "something to turn up."

For a time, indeed, things looked ominous. The rougher element said

Another evidence that the disputed land must always be American, although the point was not brought out before the arbitration tribunal, is the rough and ready humor which characterizes its inhabitants. It has the same ring as the jokes of the Texas cattleman or the Montana miner. A Canadian would not think of such an advertisement, for example, as that of the "South Dough Hotel." Among some of the inducements to patrons of this hostelry are the following:

"Crap, chuck luck, stud poker and black jack games run by the management." "Special rates for ministers and the gambling perfesh." "Every known fluid, water excepted, sold here." "Dogs bought and sold." "Insect powder for sale at the bar." "Indians and niggers charged double." "Board, $2 a square foot. Meals extra." "Spiked boots must be removed at night." "Any one troubled with nightmare will find a halter hitched to the bed post." "If the room gets too warm just open the window and let the fire escape." "All ballists desiring practice will find a pitcher on the stand." "The hotel is convenient to all cemeteries." "If the lamp goes out take a feather from the pillow and that will be light enough." "If you are fond of athletics lift up the mattress and watch the bed spring."

ROUNDING ROCKY POINT, ALASKA.

Another hostelry built up a large and flourishing business by issuing circulars which bore this legend: "The mountaineers' saloon; finest, largest and quickest line of liquors in the American possessions. It's where the jolly good fel-

lows hang out. Come here if you want to meet the boys."

A steam laundry which was established while the city was still roofed with canvas put out a sign which read:

"All kinds of washing done while you wait. Clothes guaranteed to fit after washing. Don't come if you want to kill anything."

Although there is a block on the east side which possessed a city full of people, but never a bathtub, the towns within the disputed Alaskan territory have long been used to such luxurious inventions. There was a plumber of Dyea in its palmiest days who made a small fortune in the plumbing business and whose cards read:

"Will fix you out with a porcelain-lined tub for the most reasonable rates. A bath in one of my tubs is better than a whole winter without one."

A Blistered Crown Sheet.

BY SHANDY MAGUIRE.

George Morgan is a locomotive engineer, employed by the D. R. & F. Railroad, and as good a man as the company has upon its pay rolls. His habits are excellent, he being an absolute teetotaler, reticent in speech, very attentive to his duties, and one who treats every one with respect. He has a good passenger run, being entitled to it by right of seniority, and giving good satisfaction. He has a wife and two children, of whom he is justly proud, and always at home with them when off duty.

There was considerable jealousy on the part of three or four men manifested toward him on account of an engine assigned to his trains, for which he was in no way responsible. The engine was a four-wheel connected, and about 18½x24 in. cylinders. The engine that George had being only 18 ins. diameter, with nothing to spare in power, the M. M. put the 18½ in. on the runs, which he knew would fill the bill. When "631"—the 18½ in.—was shopped, she was in charge of Dick Jones, on through freight, and was taken in for a general overhauling, including a new fire box Jones calculated on getting "631" back when she came out of the shop, but rumors were flying about that George Morgan would be the lucky one.

Dick Jones was as fine a worker as there was on the whole system—with his mouth. He was not only an agitator in the roundhouse, and out on the sidings, but also a perpetual talker in the lodge room of his order. He was steadily around with the dark-lantern of corporation hatred, looking for grievances against the company. He would occupy more time in the meetings discussing them than all the other members combined. When he gave case after case to the committee to redress, and when its members paid no attention to them, he denounced the organization, although it succeeded twice in getting him reinstated, once for drunkenness and once for carelessness. All the friends he had were soreheads of his own stripe, very few in number, the curse of the road; but endured because they managed to keep barely within the border line marking duty from devil-may-care, and the cameraderie existing between men of the one occupation, who abhorred tell-tales or informers.

Jones satisfied himself that "631," then in the boiler shop, was to be given to Morgan, and his hatred of him was intensified. When he was restored to duty, after being expelled for drunkenness, the lodge assigned George Morgan, on account of him being a teetotaler, to administer a severe rebuke, which he did, in chaste language, but which had no more effect on him than to make him a deadly enemy of Morgan's.

In due time engine "631," in all the splendor of regulation color, came out of the shop, and while being broken in Morgan was permitted to remain with her, putting on the finishing touches here and there that only an engineer knows, ere taking the run. One day, on a siding, a few miles out, doctoring a hot journal, Dick Jones passed them, and the [illegible] deepened [illegible] face as he said to his fireman: "Morgan played [illegible] good with the [illegible] to get '631,' but may be she'll be his coffin."

The engine had been on the run about five months, giving the very best satisfaction to all concerned, and looking as slick as when she left the shop, owing to the feeling of mutual fellowship, and exertions to please each other, existing between George and Tom Crosby, his fireman. One morning thereabouts Morgan was not called, but from habit he awoke and got ready to go on duty, as usual, supposing something had happened to the caller.

SKAGWAY, ALASKA.

"I wonder what is the matter, George, that the caller did not come after you this morning?" said his wife, as he was preparing to take a brief leave of herself and his seven-year-old boy, who was always up to give him "a big hug" before parting.

"I don't know, Mary; it is some trivial reason. Good bye, dear. Good bye, Georgie; be sure you come to meet me to-night to carry home my pail," and he was gone.

He saw Engine 528 where 631 ought to have been when he got to the yard.

"What's up, Jim?" he asked, as he got alongside Jim Eggleston, oiling round.

"There is something the matter in '631's' fire box. They could not send her out and they called me."

"What is it, Jim?"

"I didn't hear. She had to be dumped."

George went to the engine house. He did not feel altogether at ease, yet he knew of nothing the matter when he left the night before.

When he got there he asked Jack Daley, the night hostler, why had 631 to be dumped.

"She was leaking in her crown-sheet in one or two places. Tim Reilly sent for Jack McGraw and he ordered her dumped."

"How did it happen, Jack?"

"I don't know, George. They say you brought her in so."

"What?" said Morgan, with a sharp sound as if of astonishment. Jack made no reply, and the roundhouse foreman coming in sight, he went directly to him to get some information.

"Mr. Cool, please tell me what is the matter with 631," he said, when they met.

"That is information I would like to get from you, George. A few minutes after you left her on the pit last night the hostler found a sharp stream running from a bulge in her crown sheet. He called back your fireman and showed it to him and then reported it to me. I sent for Jack McGraw, who pronounced it a blister, and ordered her dumped. What do you know?"

"Mr. Cool, I never had a smoother run than yesterday. The engine steamed remarkably free. I never had less than a glass two-thirds full of water, and it was water that had direct connection with the boiler, for I blowed out the glass and kept the cock open sufficiently long to clean it thoroughly; so long, that Tom asked me if I found a new blow-off cock. On account of my wife's ailing, I got off the last few nights in the upper yard, and let Tom run her down, but the last thing I did every night as well as the first in the morning, was to try my gauge cocks, and I left her full always before getting off, so that water would not be required before I'd come back in the morning. Jack or Tom can tell you so."

"Did you look in the fire box before getting off last night?"

GATEWAY TO THE YUKON, ALASKA.

"No, sir. I have an understanding with my fireman; when he gets around ahead of me, he is to look critically everywhere around the fire box, and to do the same before leaving at night. I am always the last off nights, except recently, for the reason I told you."

"Well, George, I am very sorry for you, as well as for the loss of the engine. I would not charge you with neglecting your water or by being fooled by a shut-off water glass. A man daily running the one engine cannot be easily fooled that way, but the fact remains that the engine is blistered in four places in the crown sheet, leaking badly out of one of them, and all requiring to be horsed back and screw-patched."

"My God! Mr. Cool, this is terrible!"

"Yes, George, it is. Mr. Wilson wants you at his office at 10 o'clock, and also your fireman."

Morgan and Crosby were in the M. M.'s office at the appointed time, and to give in detail what was said would be but a repetition of the foregoing. Wilson was a friend of Morgan. He prized him for his manly habits, his upright life, and attention to duty. He made a rigorous search for evidence, internally wishing to find some clue to the matter other than to charge the engineer with it, but no use, as the prompt discovery of it by the hostler, and his report of the same to Tim Reilly, the night boss, gave no show. He knew the rules regarding the slightest trouble with an engine on account of shortage of water was a discharge out and out, and no reopening of the question. When he submitted his report to Mr. James Brown, the superintendent of motive power, the order came back to discharge George Morgan. Poor fellow! he felt his position keenly. He walked homeward in a dazed sort of a way, and when approaching his house little Georgie spied him and ran to carry home his pail.

"What is de matter, papa; you looks sick?"

"Oh, nothing, Georgie. How is mamma?"

"She is sick, too, papa."

George knew it but too well, and when he entered the house she raised herself on her elbow from the couch, took a sharp glance at him and said:

"Oh, George! Something terrible has happened."

His reply was a big gulping sob, and when he saw the beautiful, guileless face of his boyhood's devotion pinched, pale and wrinkled with sickness, he broke completely down, for if she showed no improvement he had intended to have her moved to a more salubrious clime for the winter, but with the loss of his job, the thing was impossible.

He broke the news to her as gently as he possibly could, but he could not disguise his breaking heart from her loving eyes. She became the consoler, pouring out words of hope and resignation with the fluency of a gifted being, and proving to the desponding fellow that on God's footstool there is not a nobler mortal than a good, pure and affectionate wife.

The lodge took it up for discussion Much sympathy was expressed for George, who was a listener, but the matter was cut short by Dick Jones calling for the enforcement of the law. This was a brutal thrust. It brought several members to their feet, who roundly berated him for his brutality in the presence of poor Morgan. The law was expulsion for the burning of an engine, and in due time was enforced.

The M. M., in reporting the matter to the M. of M. P., later on, influenced him so in Morgan's favor that he offered him a position as assistant road foreman of engines. George thankfully refused, knowing but too well that a man with his record never could fill the position in a satisfactory way.

Whether it was from the exercise of will over ailment or not, Mary Morgan began to show signs of convalescence. George got a helper's job in the boiler shop. He knew there was no use any more in him thinking he could get a locomotive to run, so he devoted himself to his new duties, hoping to get higher at the business so as to get more pay, for his family's sake. He made the acquaintance of Jim McNeill, a helper like himself. Jim took a liking to him and did everything he could to show George how to take advantage of handling the tools, so as to make the work light. Jim was a good-hearted fellow, only too good every pay night—for with a few boon companions he let the wages he got fly. George did all he could to get Jim to quit drinking, but didn't make much progress.

In the course of a few days after "631" was shopped she was out again, with two screw-patches on her crown sheet and two blisters horsed back. Jim Eggleston had her on Morgan's old run, but to his credit, be it said, he would rather see Morgan back, if it were possible.

About three months after Morgan went to work in the boiler shop Jim McNeill got arrested for drunkenness and fighting. George heard of it, and made every effort he could to get him out for the night, and to appear in the morning, and was successful. George passed his word of honor to the magistrate he would produce Jim at 9 next morning, to answer to the charge, so he did not go to work, but accompanied him to court, sitting by him in the dock. The charge was assault and battery upon the person of one Richard Jones, and through the non-appearance of the complainant Jim was discharged. On their way home George took up the old subject of reformation with Jim, and had an attentive listener. George, noticing him in deep thought, contrary to his laughing, devil-may-care way, supposed he was making an impression, and worked the harder.

Jim stopped abruptly when George ended his appeal to him to quit drinking, and looked him squarely in the face, saying: "George, I love you. You can work as a helper in a boiler shop and still be a gentleman. You are a friend to everybody. It was for thumping Jones for accusing you behind your back when he was full of Mother Hurley's tangle-foot that I got pulled. I knew he wouldn't appear against me this morning. He knows better. Patsey Miles, the little rivet heater, who was killed, told me a story of Jones getting him to go into the dome, when 631 was in for the new fire box, and lay three pieces of iron, which he gave him, on the crown sheet, between the crown bars. He told Patsey that it would make her carry water better. He did it, supposing Jones was to have the engine again, but later on, when Jones got left, he told me about it, and Jones knows I know it. You know how water scales, and you know how quick blisters will form when anything is on the crown sheet. I'd have told you long ago, but I did not know how good a fellow you were."

AUTOMOBILE AND LOCOMOTIVE TOIL ON MOUNTAIN GRADE

"For God's sake, Jim, are you telling me the truth?"

"My words can be proven. Have the crown-sheet examined."

Morgan saw a ray of hope. He ran home to his wife, who, with the eyes of love, read good news in his face. He had no committee at his back now to take the matter up, on newly discovered evidence, so he advised with the M. M., who counseled him to go direct to Lansing, and lay the matter before the master of motive power, furnishing him with a pass.

"God speed you, George," said his wife, as herself, little Georgie and curley-headed little three-year-old Carrie bade him good by at the door.

Mr. Brown heard the request that engine 631 be examined on the crown sheet, and he himself, graduating from the cab, knowing the charge Morgan was let out on, one which as a locomotive engineer he knew the enormity of, he wired his M. M. to have the engine [illegible] the next P. M. for inspection, and invited Morgan to accompany him back, as he was going out to inspect the system. George was elated. Next day the upright pipe was taken out and four flat pieces of iron, scale covered, about 14x4x¼ ins., were found just over the screw-patches by the man who went into the dome. When Mr. Brown saw them he said to the M. M.: "Mr. Williams, restore George Morgan to his old run. Pay him the wages he lost by this damnable rascality. Discharge Jones, and if you can find witnesses to convict, have him arrested on the charge of destroying company's property. George, I congratulate you. Such men as you cannot be very well dispensed with on our railroads."

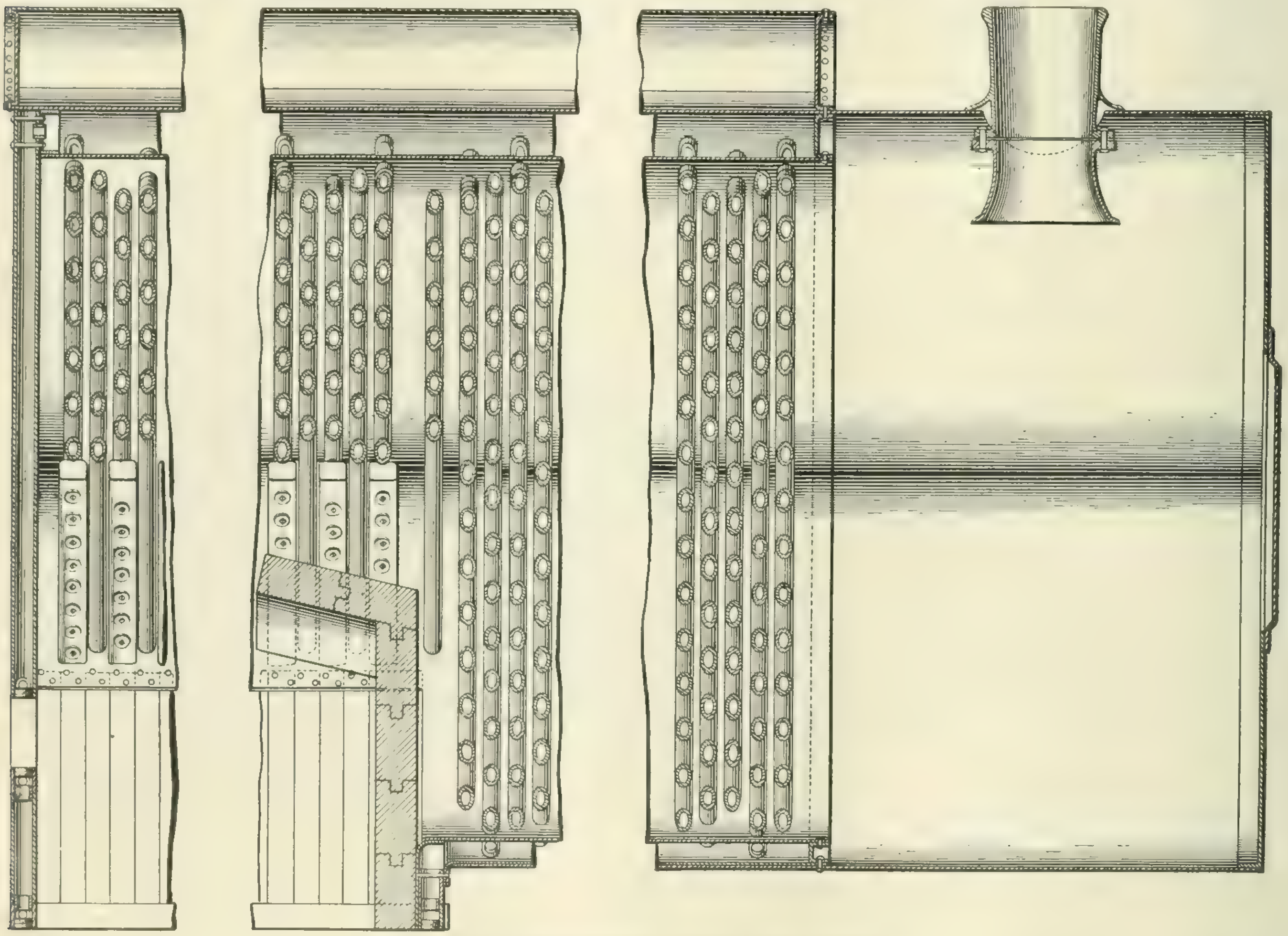
"I thank you, Mr. Brown; that't all I can say, but your kind heart can tell how mine feels. I made the mistake of not examining the crown sheet night and morning. Had I done so I'd have got on to the blisters when they were first making, but—— Poor Mary"—and he broke away to get to where his heart was tabernacled, with the good news.

There are some things concerning the action of steam in engine cylinders that are really rather mysterious, there are cases in which the immutable laws of nature seem to be violated. When steam goes into a vessel having as high temperature as itself natural reasoning would say there can be no condensation. Yet enormous condensation takes place in the carefully steam jacketed high pressure cylinder of a triple-expansion engine. There is no dispute about this being the case, but both science and experiments fail to account for it.

A Water-Tube Locomotive Boiler.

The annoyance and trouble experienced on railroads from the stayed surfaces of the fire-box has led Mr. J. M. McClellon, of Everett, Mass., to design a water-tube locomotive boiler shown in the accompanying figures. He states that one of his objects is to provide a boiler having a greater heating surface and larger flue area than locomotives of the ordinary construction have, and also one having a fire-box entirely free from stay-bolts or stayed surfaces.

The boiler shell is substantially rectangular. The opposite spaces of this tube between the shells which must act as a stay. The tubes are expanded into the shell in the ordinary manner, and may, if desired, be provided with corrugations near one end to provide for unequal expansion. The ends of the tubes are closed by caps. While the flat surfaces of these shells are stayed, the method of staying them is an advance over the use of stay-bolts, and in addition, the surfaces of these shells are never brought into direct contact with the intense heat found in a fire-box. The distance between the two shells on the two upper sides is greater than on bottom, which is perforated to allow the free passage of steam from the boiler into the drum. The water line is carried a little below the upper angle of the inner drum. In this way sufficient heat is transmitted to the steam above the water-line to partly superheat it. The throttle valve is placed in the forward end of the drum, to gain steam space by reducing the length of the dry pipe. The outer shell is prolonged to form a smoke-box. At the very bottom of the smoke passage through the boiler, a small opening is left between the tubes, through which a steam jet blower may



SECTION OF McCLELLON WATER-TUBE BOILER

shell are connected by water-tubes, alternate courses of which cross one another at right angles. As the rectangular boiler is set with its diagonal in a vertical line, the tubes all stand at an angle of 45°, which contributes to rapid circulation and free steaming.

To avoid the necessity of carrying a large stock of various sized tubes, the inventor has made all his tubes of the same length. The tubes are 3 inches outside diameter, No. 12 gauge, and are upset to 3-16 ins. where they pass through the shell plates. This facilitates their insertion, and also gives them sufficient strength in that portion of the the two lower sides, in order to allow the steam and water to separate and the water to circulate downward, while the steam passes upward to the steam drum.

The inner shell is welded so that no difficulty will be experienced from a leakage of steam in an inaccessible part of the boiler. The outer shell is made of four plates, with a lap joint at each of the three corners. These may be readily riveted or caulked in case of leakage. At the top the outer plates are flared outward and riveted to the steam drum, which runs the entire length of the boiler. This drum is held in place by a flat stay-plate, riveted across its be inserted the entire length of the boiler, if necessary to blow out any soot which may collect in this chamber.

The sides of the fire-box are made of straight seamless drawn tubes, 3 ins. in diameter inside, and 4 ins. square outside. The tubes, when placed side by side, present a substantially smooth surface next the fire. Tubes are secured to one another by steel dove-tailed keys, driven into corresponding grooves cut in the tubes. A thin copper caulking strip or sheet is inserted between the tubes. A portion of the caulking strips may be left out to admit air between the tubes over the fire, as is sometimes

desired. The shell extends back over the fire-box the full length of the grate, but is cut away and riveted to the ends of these vertical tubes. Both the forward and back ends of the fire-box are built up in the same manner as the sides. The lower ends of these vertical tubes are fastened by thimbles to horizontal headers made of the same kind of tubing. This gives sufficient metal in the horizontal tubes to withstand bursting pressure.

By taking out plugs opposite each end of any of these headers, the headers may be easily cleaned and inspected. Over the fire-box are headers of the same kind of tubing with square outside, into which are expanded short tubes leading from the header to the shell, where they are fastened in the manner already described. Sufficient space is allowed between each header and the adjacent tubes for the gases to rise and heat the water-tubes in this part of the boiler. A fire brick arch is used.

In the construction under consideration, by reason of the continuity of metal around the tubes, if a film of steam forms next the fire, the heat will still be transmitted around the tubes to the water on all sides, thus preventing the overheating of the metal of the tubes.

By setting the rectangular boiler, as shown in the drawings, it is possible to mount it over 90-in. driving wheels, and yet have its over-all dimensions within the limits ordinarily prescribed. By using a fire-box 74 ins. wide and making the boiler 3 ft. longer, the heating surface may be easily increased to about 7,500 sq. ft. The boiler does not necessitate any radical change in the construction of the locomotive frame, except that the saddle must be V-shaped on the top, instead of circular. The lower headers of the fire-box will rest directly upon the main frame.

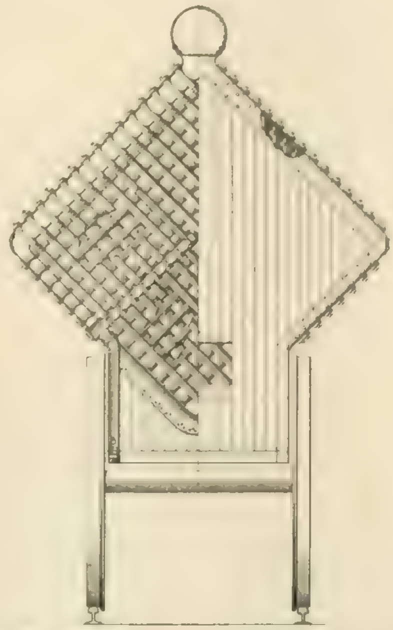
The boiler was patented October 13, 1903, by Mr. James M. McClennon, Everett, Mass., and his claims have been allowed on the fire-box construction.

Swindling Would-Be Railroad Men.

A dispatch from Washington reads: "Postmaster-General Payne to-day issued an order denying the use of the mails to the National Railroad School of St. Louis, H. L. Mebegar manager, for operating a scheme to defraud. Mebegar advertised in newspapers throughout the country for railroad engineers, firemen, brakemen and conductors, "no experience required, positions secured, free transportation to place of business."

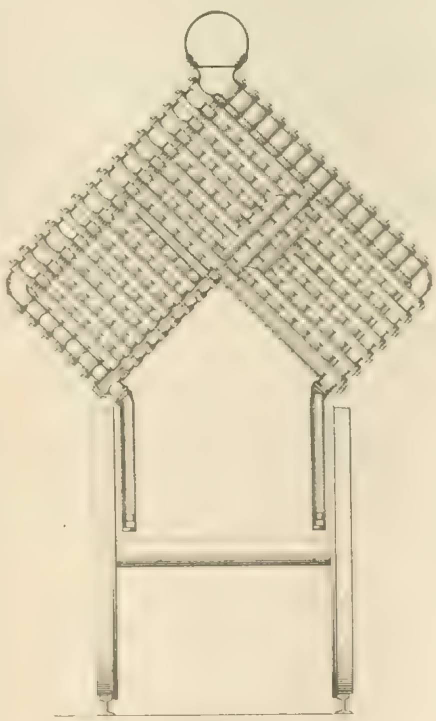
To those who remitted the necessary $5 for a complete two weeks' course at the National Railroad School, Mebegar sent a pamphlet of fifteen pages and a circular saying that if the prospective railroad man applied himself diligently, he could become proficient in the two weeks mentioned.

An investigation by the Post Office Department disclosed the fact that the president, secretary, business manager,



BACK SHEET AND SECTION THROUGH WAIST.

correspondence division, circulation division, thirty expert teachers and twenty-seven assistants were all embodied in the



SECTION THROUGH FIRE BOX

person of Mebegar. It is not known just how much Mebegar took in during the time the scheme was operated, but he is now considered wealthy, while a few months ago he was poor.

It seems passing strange to us that there was no public prosecutor in St. Louis ready to perform the duty of prosecuting Mebegar for swindling. He ought to be doing the lockstep along with other rogues.

A Speaking Example.

Mr. M. E. Ingalls, president of the "Big Four" Railway Company, and one of the prominent men of the West, tells the following amusing story, says the *Saturday Evening Post*, in connection with his experiences as a school teacher years ago in Zanesville, Ohio.

"It was then the custom, of a Friday afternoon, to have some man of quality address the pupils—such 'talks' from men of affairs being deemed of great importance to the children. Often the speaker sought to point a moral, as was the case in the instance I relate.

"One afternoon the pupils were held for over an hour by the long, prosy talk of an eminent gentleman from Xenia. In the course of this gentleman's remarks he drew an awful picture of a youth drifting to ruin. Said he: 'I knew a boy once that disobeyed his parents; played truant from school, went fishing on Sundays, learned to smoke, to swear and' (with a most impressive tone) 'to play cards! Later, this vicious lad actually ran away from his comfortable home. Falling into the hands of most depraved companions he went from bad to worse. And now, children, concluded the speaker, in a most sepulchral voice, 'where do you suppose that boy is now?'

"Whereupon the children, who, I regret to say, had paid but scant attention to the great man's remarks, shouted with one voice the usual answer in response to the question they heard every Friday afternoon:

" 'He stands before us!' "

A Volcanic Railway.

There are a great many people in the world who enjoy doing what they or others regard as dangerous, and a railway has been built up the side of Mount Vesuvius, for the purpose of giving these people an opportunity to enjoy themselves and incidentally to put money into the pockets of the people who operate the railway.

This road runs from the end of a carriage road at the foot of the mountain and the upper terminus is about 1,000 feet from the crater. The road is of the monorail type, the car wheels run on a central rail and the body of the car is balanced on it, half being on either side. The car is taken up and down by means of a cable which is moved by steam power, and the "grip" is adjusted by the movement of a wheel, like the steering gear of a ship.

The road is built over masses of lava, and sometimes the upper end of the line is so hot that the rails cannot be touched by the naked hand. The rails are often thrown out of adjustment by cracks opening in the side of the mountain. Once or twice streams of lava have destroyed portions of the line. Showers of cinders constantly fall upon the observatory, and the power house, which would most certainly be burned up if they were not made of fire-proof materials. Smoke from the crater is often so dense and so heavily charged with sulphur that employees and passengers have to cover their faces while passing through it. Fortunately for travelers on the mountain side, the wind shifts constantly and the "smoke periods" are not of long duration.

Great care is taken in operating the road. The railway office at the base is connected by telegraph and telephone wires with the observatory where instruments are placed which indicate any possibile disturbance, and when the outlook is unfavorable notice is sent down and traffic is suspended. All the upper region above vegetation is considered to be the danger zone, and it is honey-combed with holes of all sizes from which pour steam and gas, and from which at any moment molten lava may boil forth.

The railway was built by a British tourist firm, but it is said to be largely patronized by Americans.

There are quiet victories and struggles, great sacrifices of self, and noble acts of heroism done every day in nooks and corners, and in little households, and in men's and women's hearts.—*Battle of Life.*

Consolidation for the Inverness Railway and Coal Company.

The Canadian Locomotive Company, of Kingston, Ont., has recently turned out some simple consolidation engines for the Inverness Railway & Coal Company, a road which operates on Cape Breton Island. The cylinders are 19x24 ins. and the driving wheels are 50 ins. in diameter. The pistons drive on the third pair, the second or intermediate wheels are not flanged. With 180 lbs. boiler pressure the calculated tractive effort is about 26,500 lbs. The weight on the drivers is 124,000 lbs., so that the ratio of tractive power to adhesive weight is as 1 is to 4.67. The valves are of the ordinary D-slide type and the motion is indirect.

The boiler is of the Belpaire type and is 60¾ ins. at the smoke box end. The total heating surface is 1,831.24 sq. ft.; of this the tubes contain 1,691 sq. ft., are each 13 ft. long and there are 250 of them.

The tender has the ordinary U-shaped tank with a capacity of 4,000 Imperial gallons. This is equal to 4,366 U. S. gallons. The weight of the tender loaded is 96,000 lbs. The total weight of engine and tender is about 140,500 lbs. The whole machine is well proportioned and presents a neat and trim appearance. We are indebted to Mr. H. Tandy, superintendent of the locomotive works, for the photograph from which our illustration is made. A few of the principal dimensions are apended:

Weight in working order, drivers, 124,000 lbs.; total, 140,500 lbs.; wheel base of engine, rigid, 14 ft. 10½ ins; total, 22 ft. 6½ ins.; and tender, 50 ft. 1⅛ ins.; length over all, engine and tender, about 59 ft. 5 ins.; width, 10 ft. 0 in.; height, 14 ft. 8½ ins.; heating surface, fire box, 140.24 sq. ft.; tubes, 1,691 sq. ft.; total, 1,831.24 sq. ft.; working pressure of boiler, 180 lbs.; number of tubes, 250 lbs.; diam. of tubes, 2 ins.; length of tubes, 13 ft. 0 in.

Tender—Weight of tender, loaded, 96,000 lbs.; cap. of tank in imp. gals., 4,000 lbs.; coal cap., 8 tons.

CONSOLIDATION FOR THE INVERNESS RAILWAY AND COAL COMPANY.

To Solder Aluminum

A patent has been granted by the United States on a solder for aluminum which consists of aluminum 5 parts, antimony 5 parts and zinc 90 parts. To make it harder a little more antimony and a little less zinc is used. The aluminum is first melted, the zinc is then added and when this is melted the antimony is added. Salammoniac is used as a flux. When the surface is quite clear and white, it should be poured into sticks ready for use, the cinder being first removed.

Travelers who prefer land transit to that of rolling on the briny deep may now make the journey from Peking to Paris by rail. The trip gives people plenty of time to see the country, for in China the highest train speed is about twenty miles an hour, and the trains do not move at night. Passing through Russia the speed is accelerated to about twenty-five miles an hour, and the trains are run at night. We should like to look upon the strange civilization that is settled on the banks of the Yellow Sea; we should like to travel through Siberia in summer, the grave of so many ambitions, and we might endure the dreary steppes traversed in Russia by the Siberian railway, but we think on the whole when we are making the grand tour of the globe that we will take a steamer from Hong Kong through the Suez Canal to London.

General Correspondence.

Wilmarth Engines.

At page 451 of your last issue is mentioned Seth Wilmarth engines, also request is made for more information regarding them. In the early fifties a number of Seth Wilmarth engines were put in service on Delaware Division of Erie R. R. These engines were of American type, inside connected, had big brass pumps and branch pipes, and heavy brass dome covers. They were mammoths by the side of the old engines. In 1858 one of these engines was made into a coal burner and run on the Susquehanna Division by Capt. Lork. During the scarcity of engines in winter of 1863 and 1864, one of these Wilmarth engines, the 168, at different times, with the undersigned at the throttle, hauled every regular time card train and many extras on the Susquehanna Division, without breaking more than an occasional spring or spring hanger. They were good engines in every respect. There must be men, at Susquehanna or Port Jervis, that can give more correct information about the said engines.

C. M. Sheafe.

Montreal.

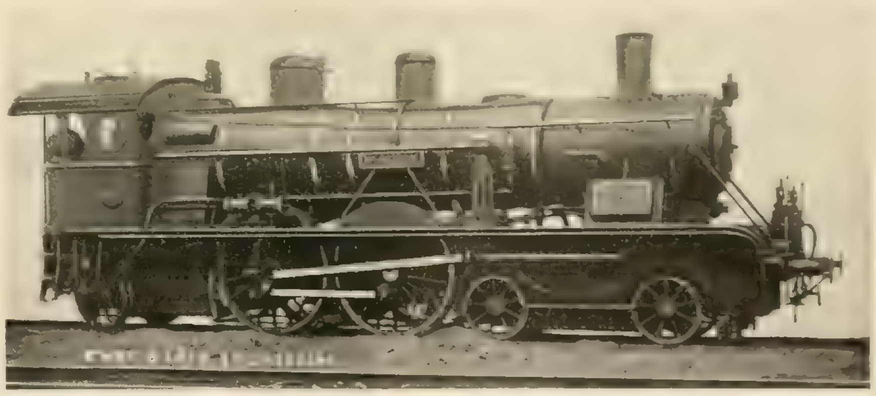
FIRST ATLANTIC-TYPE ENGINE IN GERMANY.

Atlantic Type Locomotives in Germany.

The two photos reproduced here show Atlantic type express engines, running both on the Palatinate Railways and having each a number of interesting features.

No. 1 is the first Atlantic (4-4-2) engine which has been introduced in Germany; it was built in 1898 by Krauss, Munich. There are now about twelve of this kind on the railway. It has inside simple cylinders, driving the first pair of wheels; the valve gear is a combination of Foy's and Walschaert's. The boiler is of the wagon-top type, with broad fire box, which is supported by an outside frame surrounding the driving wheels, which, however, have only inside bearings. The trailing axle is entirely free geared, and having no pin nor radial axle boxes it is controlled only by the spring pressure. This engine is the first "air cutter" of Germany, with conical smoke box cover and prow-shaped front sheet of cab.

No. 2 has already been shown in this journal, on page 421, October, 1900, but in quite another shape. It had been built by Krauss, Munich, for the Paris Exposition, 1900, and received there the "Grand Prix" for its novel features.



COMPOUND INSIDE CYLINDER 4-4-2 ENGINE.

But as these were only good in theory and bad in practice, the opinion of this journal has been proved correct, as you said: "The remedy is worse than the disease." The engine turned out to be a complete failure, for it never left the shops after it had been bought by the Palatinate Railways and made severai trials. Finally it was rebuilt. It is now an ordinary compound inside cylinder Atlantic type engine.

The cylinders are inside and much inclined, high pressure with flat valve, low pressure yith piston valve. The boiler is wagon-top with broad fire box and very long smoke box.

M. Richter.

Bingen, Germany.

An Answer to Question No. 63.

In answer to Question 63 in October issue by a correspondent from Australia, his trouble lies in a poorly balanced throttle valve. When the throttle is closed the boiler pressure has a very decided tendency to hold it closed, but when lever is pulled back to short cutoff and throttle is opened wide enough to get boiler pressure in dry pipe, it has a very decided tendency to come open quick enough to throw you back into the tank if you are holding on to it. The reason it does not do this when engine is working full stroke is because the engine is using the steam as fast as it comes into steam pipe and does not run up to boiler pressure. I am using one of the same breed of cats and know how to sympathize with your correspondent.

Locomotive Runner.

Galesburg, Ill.

Community of Interest.

The origin of all community of interest is to be found in a common possession of the inherent principles of human nature. It has been truly said that: "The great region of inquiry and interest is not the world of nature, but human nature." The broadening and unifying influence of material progress has but fertilized the soil of human nature, whose first product of progress must be a recognition of the principles of moral equity. Moses, the great law-giver, who was but the spokesman of the Almighty, first enunciated the principle that the rela-

tions of mankind should be settled upon lofty moral grounds, and it has been aptly said that: "He thus gave the first recorded impulse to civilization and linked his name with the progress of the human race." The world's history since then demonstrates that such an elevated morality, defining the distinction between right and wrong, must be the foundation of all advancement, whether individual or national. As Charles Sumner has beautifully expressed it: "Moral excellence is the bright consummate flower of all progress.

B. D. CALDWELL.

At N. Y. Railroad Club.

British Ideas of U. S. A.

We often hear of the strange ideas that Britishers have of things over here, but I think that the attached clipping from a London weekly fairly caps everything I have heard lately.

I suppose the British editor (?) thought that working "on the roof of the goods trains" meant sorting and checking freight!!!

Imagine, if you can, a modern "brakie" handling freight on top of a fast freight train running down a curving mountain grade!!!

ARTHUR W. LINE.

The picture which Mr. Line sent represented a train passing under guard lines that are set up to indicate to brakemen that a low bridge is near. In explaining their use, the British editor says: "The appliances suspended from the wire across the railway track are in use on the great American lines to prevent accidents to the freightmen who work on the roof of the goods trains during their journeys. They are placed at the mouths of tunnels and give the men warning by tapping them on the head. The roofs of American freight cars are systematically used for the conveyance of goods."

Compound vs. Simple Engines; or, An Engineer's Plaint.

Mr. Stewart, at the Traveling Engineers' Convention in Chicago this year, put the problem in a nutshell when he said that if the roundhouse does not keep up its end the compound's good work is soon destroyed. You can't get something for nothing. The compounds are not safe to go through yards, due to the vexatious steam leaks around the cylinders, and they do not ride well down grade. The poor engineer has but two hands; one is in constant use holding the throttle open, and the other on the brake valve, while the third man on the engine—the brakeman—has to read the orders, watch the time card and other minor matters, just because the machine designed to revolutionize the motive power department is not what it should be. Fault is found with the engineer if he should happen to report the wrong packing ring or have the wrong head taken off. It's not so long ago—and I am not certain but that the practice still exists—that cylinder packing on many good roads is still examined on the good old simple engines at least once each month, whether reported or not. F. P. Roesch was the only one at the T. E. convention who seemed to have any fair consideration for the engineer. Great is the "fin de siecle" foremen and the up-to-date (?) M. M. You thought that with the assistance of your mechanical expert (?) you would find something new to worry the ignorant engineer, but the worry is not all his, for you sowed a wind and are reaping a whirlwind. Who would not prefer a good compound to a poor simple engine, but no engineer on the U. P. or anywhere else prefers a good compound to a good simple engine They are like the "Indian"—only good when dead. How many of you, traveling engineers included, know anything about the compound from a knowledge gained by actual service running one? If you have this knowledge why not impart some of it to us? We are ready and ever willing to learn. All we want is facts and a little prompting.

FAIR PLAY.

Pueblo, Colo.

There is good wholesome advice in "Fair Play's" remarks that can be taken home. Every new device requires an experienced instructor for successful operation. The poor showing made by compounds is largely due to neglect on the part of some railways in having competent instructors to properly educate the engineman.—Editor.

Castor Oil Prevents Foaming.

Some years ago I read an article in your paper, written by a correspondent in Australia, in regard to the use of castor oil in locomotive boilers, to stop foaming and kill the effects of bad water.

We are using water impregnated with salt water and other refuse from 5 or 6 oil wells, and engines foam so bad it is almost impossible to do anything with them.

If castor oil is fed into boiler through overflow openings in injector, foaming will stop the instant the castor oil strikes boiler. Moreover, as much water can then be carried as boiler will stand with the best of water, and engine can be worked just as hard. Two ounces of oil administered in teaspoonful doses will last an I 7 engine 26 miles on the hill. How many miles can be made on this amount fed by a good needle-feed cup or water pipe, I am unable to say.

You can imagine the condition of water from the fact that "icicles" of salt form in boiler and around leaks at seams, etc.

I think castor oil will kill most any bad water from what I have seen of its action with this worst of all waters.

I am informed that sulphate of copper will not affect this salt water in the least. Do you know of any one using castor oil for this purpose in alkali regions in the West? It seems to me that it would be cheaper than washing out boilers frequently not to mention crown-sheets that are scorched or dropped.

This is the only thing (castor oil) that I ever saw used that would stop the water right in the engine's throat and never ease the throttle off, apparently taking effect as soon as it gets into the boiler. There are only a few of us who have used castor oil, as we had to buy it ourselves.

Will you write this up for your paper, so that your other readers may profit by it? Would it be asking too great a favor of you to find out if it is any good with alkali water?

I think Mr. Nellis has had experience with just such water on the Pan Handle, from a tank near Pittsburgh.

This is once RAILWAY AND LOCOMOTIVE ENGINEERING has paid 500 per cent. on the investment, and not the only or last time I hope, for me.

JNO. W. GRAYBILL.

Bridgeport, Ohio.

Lubrication of Piston Valves and Cylinders.

In the October issue, under head of "Proper Lubrication of Piston Valves and Cylinders," the road foreman of engines has been looking up some trouble that locomotive runners have had to contend with for years, but I am afraid that he has not figured from cause to effect, but I will give him credit for getting after the trouble even if he did start in wrong end first. Now, to begin with, I have to take issue with him on the question of the piston valve not needing as much oil to keep it lubricated as the flat valve. I contend that it is only a question of it standing more punishment than the flat valve before it kicks. Now from observations I have made I have come to this conclusion about the trouble that he speaks of: If his right cylinder was getting sufficient oil, that is, presuming that both were given the same amount, there must be a cause for the left cylinder not getting a sufficient amount, which did not exist on the right side, which could not be attributed to the piston valve as they were bathed the same.

Now, we are getting down to actual conditions, which is one of the following: Not enough oil feed to that side, or if there was it was blown out through the valve packing rings without going to the cylinder, or held up in the tallow pipe and not getting to either valve or cylinder until the engine is

shut off. Now, if the latter cause existed, he has obtained one way to remedy it even if it is the wrong way; now the probability is that this engine that he speaks of, is in service where it is not worked at more than an average cut-off of 10 inches, so that by connecting his tallow pipe to the center of the cylinder the average pressure at that point was considerably below boiler pressure while he has boiler pressure turned on his tallow pipe, at the lubricator, and the effect is a strong circulation through tallow pipe which would have the effect of carrying the oil to the cylinder as fast as it is fed from the lubricator, and, of course, the valves would get the benefit of this oil from the exhaust on the exhaust side of valve only. Now, how much better it would have been if this oil had been put through the valve in going to the cylinder so that the valve could have been oiled on both sides, or, in other words, caught it both coming and going, as it is without a doubt true that we do not get the benefit of all the oil that is put through the valves, it is only that which strikes the rubbing surfaces that is used.

Now the question is, How are we going to get the oil to the cylinder by way of the valve with any assurance of regularity? And well might the question be asked, for my experience has been with all lubricators that I have worked, they have failed to do it and I have had some experience with most all of them. Oh! Wait a minute. I think I hear a noise. Yes, and it is getting louder. Now I begin to hear what it is. It is the lubricator men wanting to be heard, and this is what they all have to say: "Our lubricator will put every drop of oil to the steam chest as fast as it is fed from the lubricator." Now that claim is very easy to make, but I think I hear the man who is using those same lubricators say, "Prove it." Now, each of them comes forward with his lubricator, sets it on the M. M.'s desk, fills the bowl full of oil and the condensor full of water, opens up the feeds and proceeds to oil the M. M.'s valves with hot air. But hold on, I think I hear the runners cry out, "He is no locomotive; come along with us on one of our high pressure engines while we take a run at a hill with the full rating behind us, and then come and land the hard part of the hill to find your valves dry with one exhaust saying 'I guess I will,' and the next one 'I guess I won't,' not much time then to shove in the throttle to get a circulation through our tallow pipe, or come along with us on one of our heavy fast passenger runs while we make a run of from 50 to 80 miles without shutting off, with the throttle laid back and lever pulled back as close as possible to save making an extra stop for water, which would make a delay that would cause us to use one-half ton of coal more or less to make up and explain to us what the lever has to say about your test in the M. M.'s office.

The lubricator man's test is all right if the lubricator was to be put on a stationary engine and connected to the boiler side of the throttle. I know that it is superfluous when I say that on a locomotive the conditions are different and what we want is a lubricator that will overcome that difference and will make the conditions the same. Now I think I hear the lubricator men who handle the automatic steam heat plugs say, "We have done this," but again I am compelled to say, "Prove it," and if you are not able to do it, get your heads together and give us an instrument which will, for if you don't somebody else will, which will not only relieve the roundhouse force, the fireman and the runner of much unnecessary work, but will make a saving in repairs; also in fuel and oil, which ought to interest all concerned.

LOCOMOTIVE RUNNER.

Galesburg, Ill.

Progress of the Last Century.

A mere surface view of the future might justify the query whether the world will ever again experience an age of such wonderful advancement as that of the last century; and while perhaps its greatest advancement was in the discovery and utilization in the interest of mankind, of material forces, such discoveries have been so great and wonderful that the new century may be forced to be content to develop and improve rather than to create. In man, himself, however, we find justification for the declaration that progress is still to be the distinguishing feature of this century. Not only in control of the material world, but in the intellectual and moral sphere, man is higher in the scale to-day than ever in the world's history and before him, beckoning him onward, the flaming torch of progress shines with greater illumination than ever before.

B. D. CALDWELL.

Pioneer Machine Makers.

The Sellers of Philadelphia have the right to be considered the greatest aristocrats of American mechanical engineering. During the revolutionary war Nathan Sellers, known as an accomplished mechanic, was serving in the patriot army. He was honorably discharged by a special act of Congress in order that he might make moulds for paper making. He was sent under military escort to York, Pa., where, under guard, he made the first pair of paper molds made on this continent, and on which the paper for Congressional use and for printing the continental currency was made.

Mr. Sellers established a prosperous manufactory near Philadelphia for making paper, wire and carding machinery. This industry was afterward conducted by his sons and his grandsons, who extended into other lines, the latter having engaged for a time in locomotive building.

Restored the By-Pass.

The Frisco tried the plan of taking the "Rabbit," otherwise known as "by-pass," off some of their four-cylinder Vauclain compound wide fire box ten-wheelers. Said they burned too much coal when used simple. After fifteen or twenty days they were replaced. They needed them to get over their grades.

WALTER G. PHELPS.

The Canadian Pacific Railway people in Montreal have a good way of finding flaws in iron or steel. Mr. E. A. Williams, superintendent of rolling stock, has introduced a new method of procedure. It is simply this: Whenever a pair of wheels is sent to the lathe for tire turning, the axle is first carefully cleaned with naphtha; this removes all the grease; then a thin coat of white paint, in which only turpentine is used, is applied, and the mixture allowed to dry. As soon as the wheels are put into the lathe, the stress in the axle, due to the process of turning, develops any flaw or crack if there is one, and it shows at once, as the grease in the crack comes to the surface. Piston rods and side rods undergo similar treatment, and the result has been that many dangerous defects have been found that would have escaped even a careful examination by the eye alone. Mr. H. Osborne is the master mechanic in charge of the Montreal shop.

The new side-door suburban cars on the Illinois Central Railroad, at Chicago, designed by Mr. A. W. Sullivan, assistant second vice-president of the company, and Mr. W. Renshaw, superintendent of machinery, have turned out to be, as everybody expected, a great success. Passengers have become used to the cars and have learned to distribute themselves along the platforms, and do not stand in solid bunches like football players making ready for a scrimmage. When one of these trains draws up, there is a door in front of every two or three people, and they get aboard in minimum time, and, what is more, they nearly all get seats. These cars have been subjected to a two-months' test and are "just what the doctor ordered." The railway people like them because they save time and serve large crowds easily. The traveling public likes them because they are many-doored and provide the accommodation paid for. With everybody looking pleasant, it would now be appropriate for the camera fiend to do his worst.

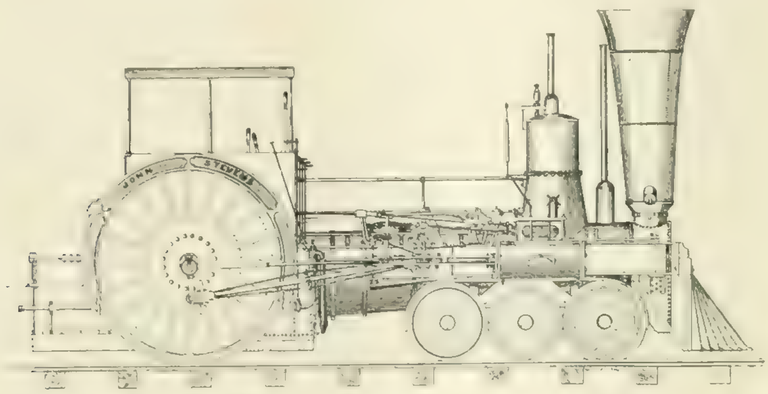
Growth of the Locomotive.

BY ANGUS SINCLAIR.

(*Continued from page 493.*)

THE CAMDEN & AMBOY CRAMPTONS.

In 1845 President Stevens visited Europe, and saw some Crampton locomotives, which excited his admiration. On returning to the United States he advised Mr. Dripps to design an engine of the same general type with a single pair of driving wheels, 8-feet diameter. The drawings were made and the engine was built by Richard Norris & Sons, of Philadelphia. The engine is illustrated in Fig. 43.



THE STEVENS CRAMPTON LOCOMOTIVE.—FIG. 43.

The order entered in the Norris books for the engine reads:

"One passenger locomotive for Camden & Amboy Ry. Gauge, 4 ft. 9⅞ ins.

Boiler 38 inches diameter, made with spiral seams, to burn anthracite coal, the steam dome to be put on cylinder part of boiler, with steam pipes leading to steam chests.

Cylinders 13x34 inches horizontal.

Cut-off. Worked from an eccentric outside of shackle pin.

Guides. Of steel with block and heads.

Cross-heads. Of wrought iron with cylindrical journals.

Wheels. Two driving wheels 8 feet diameter.

Axles. Axles 6¾; truck wheels with tires 36 inches diameter. Axles 4 inches diameter.

Tubes. 98, of iron 2 in. diameter; 12 in. long.

Name, John Stevens; No. 28; tried April 17, 1849.

The engine weighed about 50,000 pounds. Both the driving and truck wheels were made of wrought iron, and the spaces between the spokes filled with wood.

The boiler shown in Fig. 44 was very small—38 in. diameter—with but 98 flues. In the longitudinal section (Fig. 44) can be seen the plan of staying, the long rods among the flues being then deemed a necessity. The fire box was 5 feet long, no width given, but it could not have been over 48 inches; the crown bars running lengthwise were stayed to outer sheet by bolts, spaced 10 inches apart. The dome was very large, and had a flanged joint near the center of its height; the throttle was of the old slide pattern, encased in a box that was located on top of an arch pipe that went out each side of dome to the chests; there was a dry pipe above the throttle.

The fire door was below and behind the axle, and the fireman stood in a pit, the bottom of which was on a level with bottom of ash pan, the tank deck being about breast high. In the smoke box there was a deflecting plate over the tube plate, being the first case of a diaphragm being used for spark arresting.

On top of the dome was a safety valve whose lever extended to a spring scale. This was the only means of knowing the pressure carried—as steam gauges were not then in use. Near the stack is shown a safety valve that was encased to prevent the men from meddling with it.

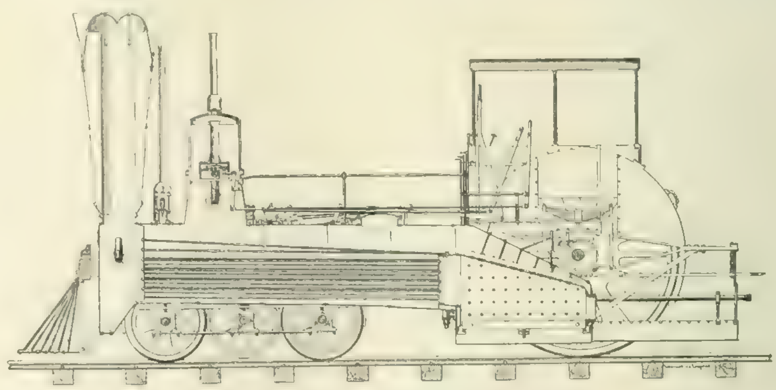
J. W. Sanford, M.M. of the Pennsylvania shops at the Meadows, Jersey City, fired and ran this engine and others of its class. He says they used to pull six of the old, light cars, but even this train was more than they could handle well. They were not provided with sand boxes, and were slippery and very slow to get a train under way, but, once in motion, with a light train, they would run as fast as men cared to ride. Mr. Sanford recalls the experiments made with different kinds of smokestacks, one of which terminated in an elbow at the top, with a loose joint provided with handles, with which to turn it out of the wind. The one shown had a place to clean it out, and the lower extension of smoke box also had a cinder slide.

The exhaust pipes were carried from the chests along each side of the boiler between the frames, and entered the side of the smoke box about half-way up. This engine and its mate had a stroke of 34 in., but the rest of the series had 38-in. stroke.

The steam ports were only 8 inches long by 1 3-16 in. wide, the exhaust ports 8 in. by 2 in. The cylinder cocks were of the old, independent kind—fireman had to run around the engine and close them up after the engine was in motion.

The 6-wheeled truck was pivoted to the boiler so far back that it carried most of the weight, making the engine very deficient in adhesion and prone to get off the track. The center pair of wheels were without flanges. The peculiar plan of arranging the truck springs is shown in Fig. 46, and seems to have some advantages over modern devices.

To the younger generation, the valve motion (Fig. 45) will seem complicated; the two wheel eccentrics were located inside the wheel and operated the large hooks, shown with the curved lifting rod. These worked the main rocker arm and the main valve, and the reversing was done by changing from one hook to the other by handling one of the levers in the cab. The independent cut-off was a small valve, riding on top of the main valve, and operated by the return crank eccentric on the main pin. This motion was transmitted to the valve through the back rocker.



SECTION OF THE STEVENS.—FIG. 44.

In starting, the cut-off lever was moved so as to engage the lower hook. This made the cut-off valve come to the center of the main valve, and, as that always ran full stroke, it would cut its own steam off, the cut-off motion merely

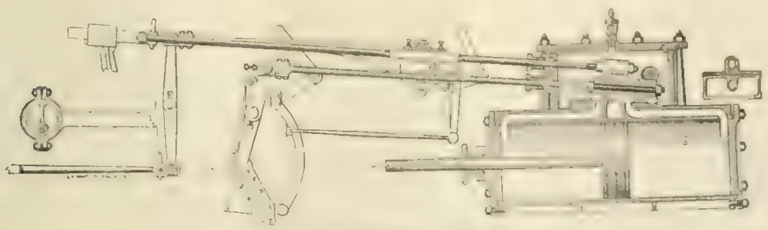
sliding the block on the upper rod back and forth, and doing no work.

As soon as the engine was under way the engineer "threw on the cut-off," which disengaged the lower hook from the main valve stem, and engaged the upper one with the cut-off valve, which traveled on top of the main valve, cutting the steam off short, much as a link does when hooked up, except that, as the main valve controlled the exhaust, the latter was carried well to the end of the stroke

These engines ran from 1849-50 to 1861-2, and one as late as 1865; two of them were cut up and the others were also cut up, with the exception of the cylinders and guides, these being used on some 8-wheeled engines with 6-foot wheels, that were built at that time.

Neither the Monster nor the Crampton class of engine became the originator of a type in American locomotive practice; but both of them possessed details of mechanism that were adopted by subsequent locomotive builders. They marked a decided line of progress.

(*To be continued.*)



VALVE MOTION. FIG. 45

A Testing Station of the Bureau of Forestry at Purdue University.

The Bureau of Forestry, United States Department of Agriculture, has inaugurated an investigation of the mechanical properties of the commercial timbers of the United States, and has established a Timber Testing Station at Purdue University, La Fayette, Ind., to form the nucleus of the work in the Mississippi Valley region. Various physical and mechanical tests will be made according to uniform methods at this and the other government stations, by experts of the Bureau of Forestry. Additional machines of a special character, belonging to the bureau, will be installed in the laboratory. The work of this station will be under the direction of Dr. W. K. Hatt, who has recently been appointed to have supervisory charge of the work of all the Timber Testing Stations of the Bureau of Forestry.

The university has for many years given a large amount of attention to the investigation of materials of construction. The results of the tests on cements and steel concrete are used by engineers at home and abroad, and the experiments on iron and steel under impact are the most extensive of their kind. The botanical department of the university has also contributed original knowledge on the microscopic structure of woods.

The selection of Purdue laboratory is, no doubt, due to the reputation which Purdue has already established. The fact that some years ago the engineering laboratory of Purdue University was made the official laboratory of the Master Car Builders' Association and has received from that association more than $10,000 worth of equipment speaks well for the character of the work it is doing. The immediate work of the Bureau of Forestry at the Purdue station will be a study of the red gum, a wood that is of very widespread growth and possesses valuable properties.

Cast Iron Thimbles for Tubes.

At a meeting of the Master Mechanics' Association, held long ago, the familiar subject of leaky tubes was under consideration and W. S. Hudson, who was then superintendent of the Rogers Locomotive Works, gave some notes of experience that might be useful to modern master mechanics. He was master mechanic of a railroad in Western New York where the feed water was bad and they had trouble with leaky tubes. It was usual to use wrought iron ferrules in the back end of the tubes and it struck him that cast iron might be better. He took some wrought iron ferrules and repeatedly heated and cooled them and on measuring them carefully he found that they became smaller. He tried the same operation on cast iron ferrules and found that they expanded. This led him to adopt the use of cast iron ferrules and it stopped the trouble from leaky tubes.

ARRANGEMENT OF TRUCK SPRINGS FIG. 46.

The report of the proceedings of the thirty-seventh annual convention of Master Car Builders' Association, has just been issued from the press. The convention was held in Saratoga on June 30, 31, and July 1, 1903. The proceedings makes a good sized volume of 620 pages, and contains as illustrations all the drawings which accompanied the reports of committees. There are twenty-three plates at the back of the book, showing M. C. B. standards, there are twelve plates showing the recommended practice of the association and a table giving the details of letter ballot for the year. Volume 37 may be had on application to Mr. Joseph W. Taylor, secretary of the association. His office is at 667, Rookery Building, Chicago, Ill.

An amusing story of Sir William Van Horne is told by Mr. W. R. Stewart in a recent issue of the *Cosmopolitan*. It illustrates the minute knowledge of railroad men and things possessed by the Chairman of the Canadian Pacific Board, and it also evidences his very keen sense of humor and love of a joke. When division superintendent on the Chicago & Alton he overheard a message from a conductor telling a night operator how the crew on a certain night run were in the habit of taking cushions out of the passenger cars, with which to make themselves comfortable in the baggage car. A night or so after he wired the conductor of the train a message which was delivered at a small and lonely way station in the dead of night. The message contained only these solemn words: "Put back those cushions," but it filled the hearts of the crew with dire consternation.

The Augusta (Me.) *Journal* is the authority for the following: "It is a fact not generally known that the use of pilots on locomotives is not required by statute law. The evolution of the pilot was brought about for the purpose of sweeping cattle from the track during the early days of railroading, until today it is looked upon as a safeguard for the general public, although it is of no special benefit in case of accident."

A president of a prominent railroad made some critical remarks to the writer lately about a paper which had been submitted to a railroad club and asked, Are there not any restrictions upon the free advertising by raiload clubs? We could not answer the question, but we think it is worthy of consideration by the various executive committees. The Master Car Builders' and Master Mechanics' Associations have been constantly worked by people wanting free advertising, but they steadfastly refused to take the bait. Their example is worth imitation by the railway clubs.

At the end of July of the present year the membership of the Brotherhood of Locomotive Firemen was 48.568, and the number of lodges 642. In the last year forty-three new lodges have been established.

The New Caledonian Engines.

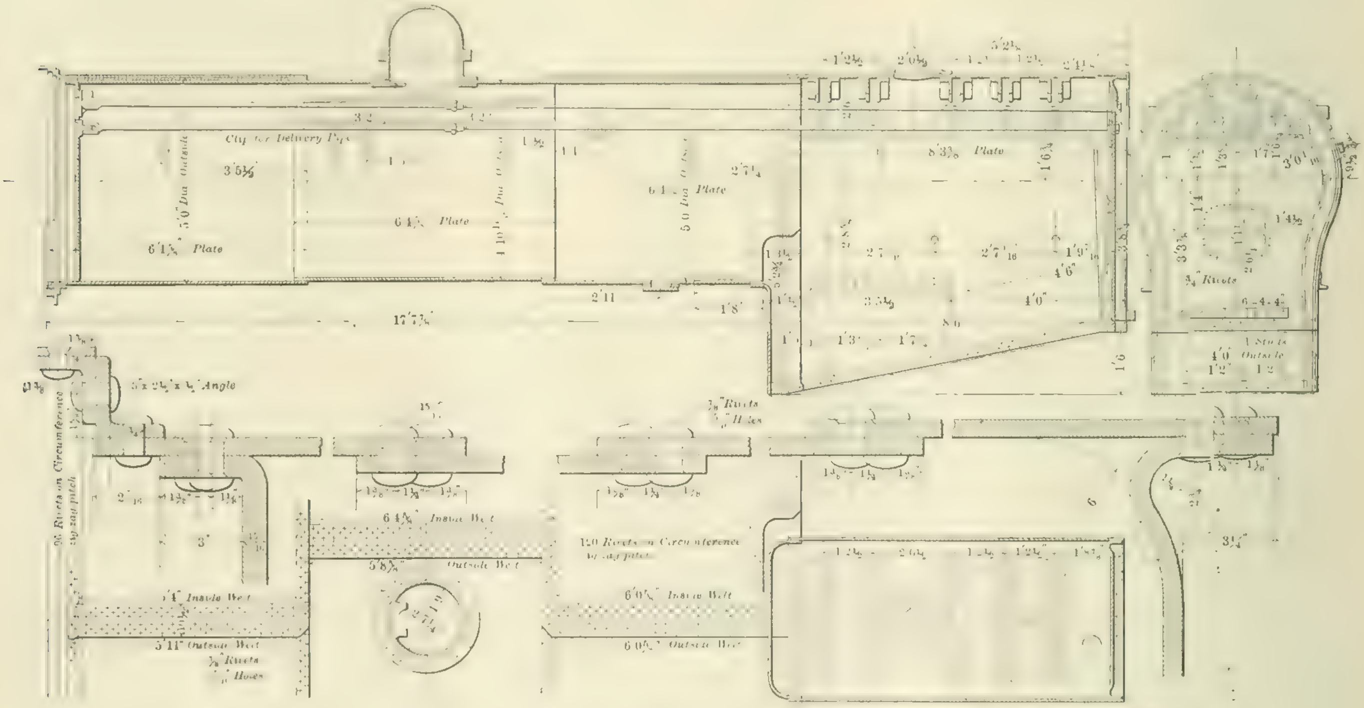
The Caledonian ten-wheelers, illustrated in the June number of RAILWAY AND LOCOMOTIVE ENGINEERING, have demonstrated the wisdom of their designer, Mr. John McIntosh, in repeated successful performances with heavy fast trains. The time of 2 hours and 15 minutes for the trip of 102.5 miles, gives an average speed of 45.5 miles an hour. This speed is remarkable only when considered in connection with the work done by these engines on continuous grades averaging 48 ft. per mile. If their performance is examined on the basis of the resistance encountered for speeds on American roads, we will have 10.75 lbs. per ton due to speed, and this with 19.6 lbs. per ton due to grade, makes 30 lbs. per ton. No data is at hand for curves, and the total resistance will be taken as above, on the grade of 1 in 102, or 0.98 per cent., where the speed at this point was 35 miles an hour and could not be influenced by kinetic energy, being a dead pull for a distance of about 15 miles. The work done is exciting more than passing comment, since the weight of engine and tender in working order is 144 tons, and that of the train load, estimated from reliable data, about 436 tons, or a total load of 144+436=580 tons, of 2,000 lbs. The drawbar pull necessary to overcome the resistance named would therefore be 17,400 lbs., and the horse power developed = $\frac{17.400 \times 35}{375} = 1.624$.

With these values before us, the evaporation, based also on American practice of 26 lbs. of water per horse power hour, is 1,624×26=42,224 lbs. per hour. In our description of this engine in June last, the total heating surface was given at 2,400 square feet; the evaporation per hour per unit of heating surface was in this case, therefore, $\frac{42,224}{2,400} = 15.5$ lbs. of water. Such an evaporation would not be expected from so small a heating surface in this country, as is evidenced by the tendency to fill up boilers with flues. Mr. McIntosh pinned his faith to a lower heating surface, preferring one that was smaller, but more effective, which has always been the policy of the foreign designer. Recent American engines of practically similar dimensions to the Caledonian, 10-wheeler, and also designed for similar service, have no less than 3,500 square feet of heating surface, and being directly comparable with the Caledonian engines, the latter stand out in strong contrast in the matter of heating surface, to an extent as to be convincing that our design of boilers is not conducive to the highest evaporative efficiency. The conviction is forced that a remedy is to be found only in an improved circulation, and to attain that desirable end, it would appear that ample water spaces around flues must be provided not only between flues, but also between boiler shell and flues at sides and bottom.

TRANSVERSE SECTION OF McINTOSH BOILER.

Mr. McIntosh has demonstrated that his new engines will steam economically on a lower heating surface than our engines, for the same work and of the same caliber. The Pennsylvania class E 3 engine approaches the nearest to the Caledonian in having a low heating surface, with its 2,640 square feet, and is properly regarded as one of the most advanced creations in this respect in this country at present.

Comparisons of the work done by foreign and American engines cannot be made with the degree of accuracy that gives a reliable tone, since there are two factors always open to doubt. These disturbers are resistance and steam consumption per horse power hour. Concerning the first of these, the conditions of permanent way, train and engine are so nearly alike that they cannot seriously vitiate results, but the fact remains that there is a wide difference in the steaming capacity of boilers, no matter what the relative cylinder efficiencies may be, and it is time that some rigid investigations were being conducted that would ex-



BOILER OF McINTOSH TEN-WHEEL EXPRESS ENGINES.

plain why similar machines doing like work should have a difference of nearly 50 per cent. in heating surfaces.

Annexed we show some line cuts illustrating the boiler of these engines. The most striking thing about the boilers is the arrangement of the tubes, the lower part having tubes 2½ inches in diameter, the principal body being filled with 2-in. tubes. Mr. McIntosh explains that this was done to remedy the trouble caused by the lower tubes getting stopped with cinders. The spacing of the tubes is also worthy of study by our locomotive designers. It has been the practice in the designing of American locomotives of late years to space the tubes so that a passage is left clear for the rise of the steam. The Caledonian engines have the tube set so that the steam has to wind among the tubes to reach the surface of the water. This practice used to be very common with our designers, but it has been abandoned of late years and it is a question if the change has been an improvement. The tubes are set with an average space of ⅞ in., while between the shell and the tubes there is a space of 5 ins. front and at the back 8½ ins. There is ample space for free circulation of the water, which no doubt has a good effect in producing good evaporation, conducing to the efficiency of the heating surface.

Some years ago, Railway and Locomotive Engineering pointed out during the time that coal saving was the rage all over the country, that frequent and carefully performed washing out of engines was introduced on some roads as a means of saving coal. The saving was effected by the constant removal of scale and heat resisting incrustation on the water side of the fire box sheets.

Fast Passenger 4-4-2 for the Big Four.

The Dunkirk shops of the American Locomotive Company have recently supplied the Peoria & Eastern, which is now part of the Big Four system, with some fast passenger power of the 4-4-2 type. The engine is simple, with cylinders 20½x26 ins., and driving wheels 78 ins. in diameter. The weight resting on the drivers is about 100,000 lbs., and the total weight in working order is 184,000 lbs. There is therefore 84,000 lbs. borne by the engine truck and by the carrying wheels at the rear. The weight of the engine and tender is 213,000 lbs.

The valves are of the piston type and the valve gear is direct acting, having transmission bar passing, with an easy curve, over the axle of the leading driver. The rocker has both arms of equal length hanging down from the rocker-box. The eccentrics are placed, as is necessary with direct motion, so that the belly of each of them is on the side of the vertical center line of the axle, remote from that of the crank-pin. The springs are overhung with cast steel equalizers between drivers, and between main drivers and carrying wheels.

The boiler is an extension wagon-top one, and is 68⅜ ins. at the smoke-box end. The staying of the crown sheet is radial and the dome is well forward on the third barrel course, with its center about 60 ins. away from the flue sheet. The heating surface is 3,196 sq. ft. in all, about 3,015 sq. ft. being in the flues, which are 362 in number and 16 ft. long. The grate area is 44.8 sq. ft.

The running board is raised in its central section to accommodate the main reservoir, and a cast iron step at the front end of it enables a man to pass on to the foot rest over the cylinders.

The tank has a water bottom and will hold 6,000 U. S. gallons, and the 12 tons of fuel can be carried. A few of the principal dimensions are appended for reference:

General Dimensions—[illegible]

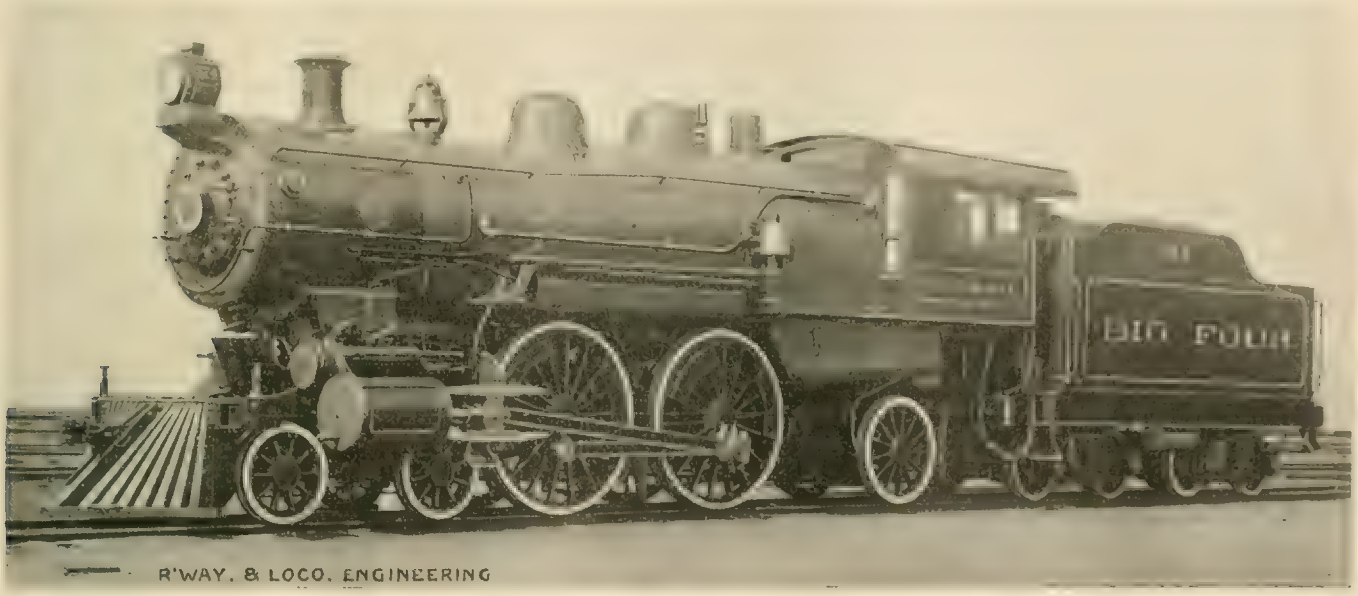
Cylinders—[illegible]

Valves—[illegible]

Wheels, etc.—[illegible]

Boiler—Working pressure [illegible] ⅝, ⁹⁄₁₆, ½, ⁹⁄₁₆ ins.; fire box, length, 97 ins.; fire box, width, 68 ins.; fire box, depth, front, 80 [illegible] ⅜ in.; back, ⅜ in.; crown, ⅜ in.; tube sheet, ⅝ in.; water space, front, 4 ins.; sides, 3½ ins.; back, [illegible] ins.; smoke stack, top above rail, 14 ft. 9 ins.

Tender—Wheels, dia., 36 ins.; journals, dia. and length [illegible] ins.; wheel base [illegible] ft.; water capacity, 6,000 U. S. gallons; coal capacity, 12 tons.



FAST 4-4-2 ENGINE WITH DAVIS COUNTERBALANCE FOR THE BIG FOUR.

The locomotive engineers of the Baltimore & Ohio Railroad have organized a brass band. There are twenty-eight pieces in the organization.

On October 31 a terrible accident happened to a special train on the Big Four in the yards of Indianapolis, whereby sixteen people were killed and many others injured. The accident was caused by freight cars being pushed into the side of one of the passenger cars. Efforts were made to place the blame upon the engineer of the special for not having his train under proper control in the yard, but the coroner's jury held the train dispatcher responsible for not having advised the yard master that the special train was on its way to Indianapolis.

Railway and Locomotive Engineering

A Practical Journal of Railway Motive Power and Rolling Stock.

Published Monthly by

ANGUS SINCLAIR CO.,

174 Broadway, New York.

Telephone, 984 Cortlandt.
Cable Address, "Loceng," N. Y.
Glasgow, "Locauto."

Business Department:
ANGUS SINCLAIR, President.
FRED M. NELLIS, Vice-President.
JAMES R. PATERSON, Sec'y and Treas.

Editorial Department:
ANGUS SINCLAIR, Editor.
F. M. NELLIS, GEO. S. HODGINS, JOS. A. BAKER, Associate Editors.

Advertising Department:
Eastern Representative, S. I. CARPENTER, 170 Summer St., Boston, Mass.
Western Representative, C. J. LUCK, 1204 Monadnock Block, Chicago, Ill.

British Representative:
THE LOCOMOTIVE PUBLISHING CO., Ltd., Amen Corner, Paternoster Row, E. C., London.

Glasgow Representative:
A. F. SINCLAIR, 7 Walmer Terrace, Ibrox, Glasgow.

SUBSCRIPTION PRICE.

$2.00 per year, $1.00 for six months, postage paid to the United States, Canada and Mexico. For other parts of the world, $2.50 or ten shillings. Single copies, 20 cents. Remit by Express Money Order, Draft, Post Office Order or Registered Letter.

Mailing address can be changed as often as necessary—always give old and new address, and if you subscribed in a club, state who got it up.

Please give prompt notice when your paper fails to reach you properly.

Entered at Post Office, New York, as Second-class mail matter.

Leaky Fire Boxes and Tubes.

We do not know of any subject which has received so much investigation and discussion, from railway associations and clubs, as leaky fire boxes and tubes, and we are safe in assuming that no explanation for delay of trains is so frequently given as "leaky flues." Leaky tubes have been an annoying cause of trouble ever since railway motive power began to be used, but it seems to us that the evil is more aggravating to-day than it has ever been in the past. The amount of work a locomotive has to perform in a given time has been very much increased of late years, and this has in proportion increased the causes of leaky tubes. The increase in the length of the tubes has entailed greater expansion and contraction, while the increase of boiler pressure has raised the temperature somewhat, all tending to put greater stresses upon flues and fire box sheets.

In the numerous public discussions which we have heard and read concerning leaky tubes, bad feed water was blamed for the greater part of the trouble, but there are delays and annoyance with leaky sheets and tubes in regions where no complaint is made against mineral infected feed water. In a recent issue we mentioned a case where the engine-house people were in the habit of covering fires over with planks, to enable boiler makers to enter the fire box to do work without drawing the fire. That particular action would not do any harm to the boiler, but it represents a strenuous condition of locomotive operating which is responsible for the greater part of the annoyance from leaky sheets and tubes. The railroad is exceptional when locomotives, and especially their boilers, receive fair treatment.

When the best possible treatment is accorded to it, a locomotive boiler is constantly subjected to destructive strains and stresses that struggle to disrupt its elements, but they adhere wonderfully together, and it is only under shameful treatment that they display premature signs of distress. The heat, to which a locomotive boiler is erratically subjected, demands that the water side of the heating surface be maintained as free as possible from non-conducting substances that prevent the heat of the fire gases from being readily conveyed to the water; but it seems the rule, rather than the exception, to permit masses of mud and scale to cover the heating surfaces without proper care being taken to remove the heat-arresting material. When anything obstructs the passage of the heat to the water, the sheets have to endure the punishment of being spasmodically overheated. With the vast extremes of temperature between overheating and sudden cooling, the sudden ranges of expansion and contraction put irresistible stresses upon fire box sheets, that manifest themselves in cracking or breaking of stay bolts, and the tubes are expanded and contracted so incessantly that the ends become loose and leak. An unusually intelligent boiler shop foreman, who has charge of the boilers of a large railroad system, told the writer that he was convinced that more than half the trouble from cracked side sheets and leaky tubes was due to hurried and defective washing of the boilers.

Here is a common experience of a locomotive boiler. It comes from the makers in the first-class condition that the best of material and good workmanship can produce. It is put into service. At one time it is being forced at its utmost capacity to produce the steam necessary for pulling a train up a long and very heavy grade. The water has fallen low during the ascent and at the summit both injectors begin forcing water into the boiler while the fire is permitted to burn low. Toward the foot of the grade the blower is set going fiercely, then the fire box is loaded and another spurt of hard work performed. Suddenly the train is run into a siding and frequently waits for hours before the order to proceed is given. Meanwhile the fire has become low, and when the order to proceed is given the screaming blower heats up the boiler as fast as it can be done.

When the engine reaches the end of the trip the fire cleaner forces the live coal and clinker through a dump grate located under the tube sheet and keeps the blower drawing cold air directly into the hot tubes. Then the engine is run into the house with dampers open and permitted to cool as rapidly as the cold blast of probably a winter wind will perform the operation. But worse even than the cold blasts of air is the action of the injector, which is nearly always kept pouring water into the boiler after the fire has been drawn, and there is no heat to counteract upon the hot sheets and flues the chilling effects of the cold water.

Perhaps the boiler needs washing out and the transportation officials are demanding that the engine be returned immediately to take out another train. The steam is blown off, cold water forced through the feed pipes, the washout plugs are removed and the washing out done before the sheets not touched by the water get time to cool. On some roads the cooling process is carried out even more expeditiously. The blow-off cock is opened outside the engine house and the water blown out until steam begins to flow, indicating that the water has all run out. Then the steam is used to move the engine into the house, the steam is then blown off and the washing out hose applied. When the washing out process is finished the boiler is filled with water and a blower operated by steam from the round house boiler is put into action, and the fire stimulated with all the energy that a strong artificial blast can produce. We have heard mechanical officials boast that they originated or perfected the method of applying a blower to a cold engine so that steam might be raised in a hurry. They did not realize that they aided in bringing into use a practice that is criminally destructive to boilers. In marine service care is always taken to heat boilers gradually and to give them time in cooling, so that destructive strains may be prevented; but in railway service the rule is to heat and cool with as little consideration for expansion and contraction as if such a thing did not exist.

We suppose that railroad organizations will keep on discussing the cause of leaky fire boxes and tubes, but no new light is needed on the subject. Hard feed water will deposit scale which causes leakage, but it can be remedied in a great measure by using a water-softening plant and washing out the boilers properly and giving the boilers time to cool a little before cold water is forced into them. If railway officials think it pays their company to hurry boilers to destruction by destructive

usage such as we have described and is going on every hour, they cannot complain that their policy brings its logical results.

Asking Something for Nothing.

Men who would not expect for a moment to ask advice of a lawyer or a physician without paying for it, seem to forget that the same law should hold good in mechanical affairs.

Inventors, and men who are about to invest money in inventions, will walk into the office or the home of some mechanical expert and ask questions, get plans and drawings examined, or seek advice, that none but an educated mechanical engineer would be competent to give, without thinking of paying for the service rendered.

A man who graduates from any of our great technical schools spends more money and more time to get his education than a lawyer or a doctor does.

If a competent mechanical engineer was consulted before any machine or device was placed on the market, there would be fewer failures and disappointments, and it would be a good investment to pay well for their services in any case. Men who want to use the brains and training of these mechanics, without pay, would resent an impeachment of "sponging" on anybody; yet to the expert making his bread and butter by using his brains and training they are very despicable dead-beats.

There is another class of men, or a few of the same class, who seem to think that a mechanical newspaper exists for no other purpose than to do their expert designing for them. They will ask questions in mathematics that any fair scholar in their own place could work out in a few minutes. They want you to design engines for certain work, valve gear for certain engines, and boilers for a dozen different purposes, each stating many local peculiarities that materially affect the case, and where the sound judgment of a first-class mechanic is necessary to insure success.

One of this class wrote us not long ago, asking for the required horse power, sized boiler, sized screw, pitch of screws, etc., necessary to drive a boat 22 feet long eight miles per hour. Now we do know barely enough about locomotives to get along, but what we know about boats is limited—something like our correspondent's information on the same subject. We wrote him that if we were in his place we should employ a competent man to work out the problem, and offered to recommend a mechanical engineer, if he knew of none. We received a postal card reply as follows: "The reeson you don't answer wright is becoss you don't no, you editors aint so smart as you pretend."

The information conveyed in the last sentence of the rebuke came as a great shock to us; but, after calmly thinking it over, we decided not to commit suicide, but to struggle along, as we had before, without knowing everything.

This is the age of the specialist. Each man can learn to be an expert at one thing—if it's only opening clams—and by exchanging products we can all get expert service in everything that goes to make up our lives. An expert mechanic will verify your plans or point out their weak points in a few minutes, and perhaps save you thousands of dollars; but don't expect his services for nothing, nor that he will charge by the hour. He has got to have something for the time spent in educating himself.

The Engineman's Plaint.

On another page we reproduce a letter from one of our many readers showing the unwise policy followed by some lines. We frequently have letters of this nature asking our advice and good offices to improve their conditions. Often too little heed is paid by superiors to suggestions made by the engineman that might improve conditions on the road.

If he has to use water in the locomotive heavily impregnated at certain seasons with sulphates or carbonates of soda and magnesia, which cause excessive foaming, and has the temerity to ask the trainmaster to set out cars enough to handle the train, he is met with a rebuff. Generally the rebuff comes from some overzealous clerk to whom a locomotive merely represents a certain number, classified, and rated at so many tons. Not satisfied with the original delay report several weeks of useless correspondence are kept up on this same delay. The engineer has long since discovered that the *Brown System of Discipline* is a farce on his line. He receives no credits for meritorious work, but the demerits, like the sword suspended by a hair over Damocles' head, are continually threatening him. He quietly buys bran to stop a leaky boiler. Somebody has told him that bluestone will stop water in a boiler from foaming, so he buys bluestone, regardless of the effects on the boiler, so long as he can stop the foaming and steer clear of those delay reports.

Our correspondent writes: "We have tried bluestone in our boilers without result. Our water comes from the mines and is full of salts of some kind. We have tried castor oil as you recommended in one of your issues several years ago, with excellent results. You have helped us in this matter and hope you will give us other good receipts. While the castor oil prevents foaming, still there are only a few of us who use it, as we have to "buy" it ourselves.

Bluestone will stop certain waters from foaming, but it is an unsafe remedy, as it seeks out all the weak spots, starts flues and seams leaking, corrodes the steel sheets and leaves a residuum on the outer seams similar to syrup. In alkali districts, such as can be found on the wetern transcontinental lines, the best and most effective remedy is unslaked lime and a good surface blow-off cock. This remedy acts equally well on sulphates and carbonates, reduces scale and leaves no bad after effects.

The proper method of treating water is at water stations, before it enters the engine tender. We know the difficulties the engineman encounters and his horror of meaningless correspondence, but we feel like censuring him for being so foolish in spending his money for something that is not appreciated. If practical demonstrations of castor oil or anything else of merit will not convince the company that it is a good investment, let the company take the other alternative and set out cars until you can handle your train, without the risk of dropping a crown-sheet, and your suffering a dismissal.

A Waste of Wood.

The varieties of hard wood in general use among manufacturers of staves, furniture, wagons, implements, etc., have largely disappeared from the extensive forest areas of the Western States. In respect of black walnut, this is conspicuously true, for that timber is now confined to a comparatively limited area in isolated localities. And yet it was once abundant in the West; its presence in Michigan gave rise to the extensive furniture industry of Grand Rapids, as did its presence in Indiana to the manufacture of machine tables and cabinets at South Bend, Ind., by one of the greatest sewing machine companies in the world. But these and other concerns established in the black walnut districts have practically stripped the country of this timber from the lakes to Eastern Kansas. In Arkansas and the Indian Territory the woodsman's ax is completing the work of destruction west of the Mississippi. Even the walnut stumps, left in the earth when the trees were felled, have for several years had a market of their own, and are bought at fancy prices because of the irregularity of the grain.

White oak is another failing wood. It has practically disappeared from Ohio and Indiana; but in Southern Missouri a good deal still remains, and in Arkansas there is an immense body not as yet accessible in the main. The great area of white oak timber now left standing is, however, to be found on the slopes of the Southern Alleghany mountain region, in Southern Virginia, Eastern Kentucky and Tennessee, Western, North and South Carolina, Northern Georgia, and to some extent in Northern Alabama and Mississippi.

Unfortunately, perhaps, the railroads are among the heaviest consumers of white

oak. For cross ties their demands are particularly destructive, since the younger timber is sought out by the tie contractors and cutters. In the South the inroads in white oak for railroad uses has been so severe as to prompt a special forestry report from the Department of Agriculture, wherein it is shown that chestnut oak is preferable to white oak, when the bark is peeled from the former, for tanners' requirements, as a wood for cross ties. Most roads, however, and especially those in the South, call for white oak in their specifications.

The report which the department furnishes on this branch of the subject shows that millions of feet of tan bark or chestnut oak are rotting in the forests, after being stripped of their bark, because their value for cross ties is not known or is underestimated in many regions. And the effect of this does not stop at the waste of the wood itself, for their is waste of the bark also, as without demand for the wood it does not pay to peel the larger limbs. On the line of the Louisville & Nashville Railroad alone, south of the Tennessee river, between 5,000 and 7,000 cords of bark are shipped annually, involving the felling ot 10,000 to 13,000 trees. This timber is consigned to useless destruction, although capable of yielding not less than 100,000 first-class railroad ties.

Books Reviewed.

Locomotive Breakdowns, Emergencies and Their Remedies, by Geo. L. Fowler, M.E. Publishers: The Norman W. Henley Publishing Company, New York. 1903. Price, $1.50.

This book contains 244 pages and is a catechism on breakdowns and accidents to locomotives on the road and gives directions how to repair them with appliances such as are usually carried on the engine itself, or which can be readily procured. The simple and compound engine are both taken up and emergency repairs described. The book is divided into an introduction and seventeen chapters, and is clearly illustrated throughout with line cuts showing how repairs are to be made. It contains a comprehensive index and the last three chapters deal, first with shop tools and appliances for making engine repairs, air brake troubles, and first aid to the injured. The book ought to be useful on the road and in the shop.

Elements of Steam Engineering, by H. W. Spangler, Arthur M. Green, Jr., and S. M. Marshall. Publishers: John Wiley & Sons, New York. 1903. Price, $3.00.

This book is intended for the beginner, and brings before him examples of the various forms of steam apparatus used in modern steam power plants, and explains the construction, use and reasons for using the parts, or the machines described. The first three chapters deal with boilers, their details and accessories and boiler-room auxiliaries. The next four discuss the slide valve, engine details, valve motions and indicating, and the two concluding chapters are devoted to governors and valves, and condensers and multiple-expansion engines. With index, the book contains 275 pages, and is profusely illustrated throughout with line cuts and half-tones. In make-up it is covenient for the reader, as each paragraph contains in large type, the subjects with which it deals, and these sub-heads are enumerated in the index. The printing and paper are of good quality.

The Gas Engine, by F. R. Hutton, professor of mechanical engineering in Columbia University. Publisher: John Wiley & Sons, New York. 1903. Price, $5.00.

This work is a treatise on the internal-combustion engine, using gas, gasoline, kerosene or other hydrocarbons, as a source of energy. There are 83 pages of printed matter, and 243 figures, and it contains an alphabetical index to subjects. It is well printed, and the cuts stand out clearly.

The opening chapters deal with combustion, mechanical energy from expansion and the heat engine cycle. There then follows a description of eight types of engines burning gas, six using kerosene, several using gasoline, and alcohol engines. Then comes chapters on mixtures, carburetors, ignition, governing, cooling of the cylinder, combustion chamber and exhaust, and one on manipulation of gas engines which gives practical instruction, among other things in stopping, starting lubrication and causes of failure to operate. The performance of gas engines by test follows, and this is succeeded by a long chapter on the theoretical analysis of the gas engine, which involves much higher mathematics, and may even be open to the charge of allowing the ostentation of scholarship to become temporarily too prominent. Inter-combustion engines, and experiments on explosive mixtures, with a short concluding chapter, finish a work which is perhaps the first important American contribution to the subject of which it treats.

Switch Lights, by Edward E. Sheasgreen. Illustrated by P. J. Carter. Publishers: Iron Trail Publishing Company, Minneapolis, Minn.

This book contains a collection of eighty-seven poems of railroad life and work and tragedy. They are grave or gay as the thought and fancy of the author prompts him, in dealing with the various scenes and experiences of the ordinary railroad man.

Requesting Information by Circular.

The chairman of a committee of a railway club that was trying to collect information by sending a list of questions to be answered by railway officials, makes the following melancholy comment: "The encouragement given to club committees by railway officials in giving out information, in the opinion of the committee, should be referred to a Society for the Prevention of Cruelty to Animals." There is no mention on whose behalf the society should bear the brunt of cruelty, but we think it ought to lighten the woes of the poor overburdened official, who is bothered beyond endurance by requests for information on all sorts of subjects that he has given little attention to.

That worn out practice of sending out a list of questions for railway officials to answer is not fair, and people preparing papers for railway clubs should be discouraged from using it. The practice was begun in the Master Car Builders' Association many years ago, and caused so much complaint that it is seldom resorted to nowadays. It became gradually recognized in both the Master Car Builders' and Master Mechanics' Associations that the chairman of a committee who used circulars of inquiry to obtain the information he wanted was not a competent collector of facts.

The Engineer's Influence on Train Loads.

Speaking about the working of "tonnage rating," a railroad official who is in close touch with transportation matters in the North-West, said: "I think it is a good idea for the train dispatcher using his own discretion as to what tonnage should be handled by trains, provided the superintendent will give him authority to use his judgment in that line. I find that an engineer is in a position to tell more about the capacity of his engine than the dispatcher; yet at the same time, if you will let him use his own judgment, he will frequently reduce a greater amount of tonnage than is actually necessary, and I believe he can generally haul more than what he says he can.

"I was on a freight train last week, and the conductor told me that he must reduce his train at next station, because he had 60 tons more than his rating. I told the conductor to say nothing about it to the engineer, as I was confident he could pull the train over the hill. My advice was followed and the train was taken over all right, but the engineer seemed to feel that the tonnage was greater than usual, for he sent the head brakeman back to see if there was not a brake stuck somewhere. Yet he had 60 tons more than his rating and handled it without difficulty. For such reasons I think that it is necessary sometimes for

the dispatcher to make an arbitrary ruling and tell the engineers to take so much tonnage, whether in their opinion they can handle it or not. I have always found a similar result when the engineer was allowed to use his judgment about coal. Sometimes we would get a message from an engineer asking to be permitted to reduce his train on account of being short of coal. When this permission was refused, nine times out of ten the full train would be taken through to the coaling station without running for coal."

The Modern "Jolly Miller."

Ancient song and tradition have given the "jolly miller" a character for honesty and fair dealing that raised his dealings away above the petty tricks of trade. The modern representative of the grinder of corn does not appear to be well maintaining the old honor of his craft. A discussion at the North-Western Railway Club on "tonnage rating of trains," conveys serious reflections on the milling fraternity of the Northwest.

An official of the Chicago, Great Western Railway said: "I ride freight trains considerably, and I find there is a vast difference in the hauling of trains reported to have the same weight. Engineers complain that some trains haul harder than others from causes hard to explain. The greatest difficulty we have in handling our tonnage is in cars that are known as special flour cars, or trains loaded by the millers of Minneapolis, and they are supposed to give us the actual tonnage. We find, however, that this is not the case, and cars will run from three to five tons in excess of the tonnage as given by the millers. That is a constant source of trouble, causing our trains to stall and double, and not only delaying themselves, but other trains by reason of the tonnage being in excess of the rating."

The modern representation of the "Jolly Miller" is far removed from the dusty workmen who used to regulate the clatter of the mill stones and give fair weight for grain received. He is a silk-stockinged individual, often a politician of high degree. We wonder if the social elevation is accompanied by moral degradation? Cheating railroad companies by underbilling of weight is a mean species of dishonesty.

Horace Greeley was noted for the way he could swear without using oaths. He said that of all horned cattle in a newspaper office, the college graduate was the most useless. We heard the chief draftsman of a big office paraphrase Greeley's remark, but he used plain cuss words. The modern college graduate must be an improvement over the old stock, for he is a welcome help in most offices.

QUESTIONS ANSWERED.

(73) J. S., Hamilton, Australia, writes:

In starting out on a trip I often find the sight feed lubricator "Detroit" not feeding and by simply shutting off steam from the boiler (and leaving the bottom valves of sight feed glasses open) the oil immediately starts to pass up the glasses, then turning the steam on again from boiler, they continue to work. This little "dodge" proves successful nine times out of ten. Kindly give cause? A.—There is in the oil a certain amount of sediment, which cannot be taken out by straining, and this sediment which is really made up of minute particles of solid matter in the oil does occasionally clog the small hole through which the oil feeds. When you shut off the steam it relieves the pressure in the lubricator, and the condensation of the steam left in the lubricator when you shut off, causes a slight reverse flow. The water in the sight glasses passes down through the oil feed to help fill the central chamber, and in doing so the obstruction in the oil feed nozzle is removed.

(74) B. M. H., Cape Town, writes:

In the March, 1903, issue of RAILWAY AND LOCOMOTIVE ENGINEERING there is an article on "Simple vs. Compound Lubrication," page 116, in which it is stated that the standard rate of lubrication for locomotive cylinders and valve faces in America is 5 drops per minute. Would you kindly inform me if this applies to a sight feed lubricator with one glass, the drop being divided between the two cylinders, or to a sight feed lubricator with two glasses and an independent feed to each cylinder? A.—The statement that "the standard rate of lubrication for locomotive cylinders and valve faces in America is 5 drops per minute" is a very broad one, and would be more nearly correct and more conservative if it had stated that the average of the standard rate of lubrication for locomotive cylinders and valve faces in America is 5 drops per minute. The rate of lubrication depends very much on conditions under which the engine is working, the kind of service in which it may be, and it varies all the way from 3 drops to 10 drops per minute per cylinder. In the article referred to the reference was intended to mean 5 drops per minute per cylinder.

(75) H. I. M. asks:

What is the meaning of the word "angularity" as applied to the main and side rods of a locomotive? A.—The side rods do not have any angularity; they are always parallel to the line of motion of the piston and cross-head. What is called the angularity of the connecting rod affects the motion of the piston in a curious way. When the crank pin is on the forward quarter, the piston is at the end of [illegible] to the front cylinder cover. When the pin reaches the bottom quarter, the piston has moved something more than half its stroke, but when the pin reaches the back center, the piston is at the end of its stroke and is close to the back cylinder cover. When the pin comes to the top quarter the piston has not traveled quite half way back in the cylinder, but when the pin again reaches the forward quarter, the piston is at the end of its stroke close to the front cylinder cover. Thus it is apparent that in a full revolution of the crank pin, the piston will have traveled less while the pin was making the half revolution farthest from the piston, and it will have traveled more while the pin was making the half nearest the piston. In the case we have been considering the pin described something more than half a revolution while the piston was going from exact mid-position to back cylinder cover and returning to exact mid-position. The pin also describes something less than half a revolution while the piston moves from exact mid-position up to front cylinder cover and back to mid-position again. This can be easily understood by mentally picturing the connecting rod as attached to the cross-head in the usual way, but having the center of its big end placed exactly opposite the center of the driving axle, the cross-head then being in its exact mid-position. Clamp the cross-head there, and using the connecting rod as a radius, lower the big end down to the crank pin circle and the position which the crank pin must assume under the circumstances will be at a point slightly inside or on the cross-head side of the vertical line passing through the center of the driving axle. Similarly if the big end be raised up to meet the crank pin circle above the axle, the position of the pin will again be inside or on the cross-head side of the vertical center line of the driving wheel.

(76) T. S. M., New York, writes:

I have had a discussion with a friend about turning off an eccentric without changing the throw. My friend says if you turn off say, a half inch, you decrease the throw of the eccentric, he says it is the same as moving the crank pin nearer the center of the wheel. I contend that turning off the outside of an eccentric does not alter the throw. Who is right? A.—You are right. Turning off the outside of an eccentric does not alter the throw. The distance from center of the axle to the center of the eccentric is the throw. Turning off the outside does not affect this distance. The crank example is misleading. Turning off the outside of the eccentric would be equivalent to reducing the diameter of the crank-pin, not altering the position of its center. The difference between the short side and the long side of an eccentric is always

equal to its throw, the diameter may be anything.

(77) B. McC., Louisville, Ky., writes: Will you please answer in your question column what percentage of strength coal loses by lying on a bin exposed to the weather? A.—There is a slow chemical action going on all the time with coal from the moment it is taken from the mine. The oxygen of the air attacks the carbon of the coal and forms carbonic acid gas, also the oxygen combines with what is called the disposable hydrogen in the coal and this forms water. Heat is evolved by both these actions. If this heat is allowed to accumulate, spontaneous combustion is the result, a free circulation of air prevents the danger of fire, but the chemical action cannot be checked. It is analogous to the process known as rotting in the case of wood. It is impossible to give the percentage of loss, as it varies with the length of the time the coal has been exposed, and it varies according as the atmosphere is generally dry or damp and it varies with the quality of the coal itself.

(78) J. A. B., Pueblo, Col., writes:

1. With a 100-ton Vauclain compound, 50 miles from end of division, valve stem key gone and end of stem battered so it will not enter the head. How would you proceed? Engine has no clamp for valve stem and the bolts in back end main rod cannot be driven out. Bulletin says engine cannot be run over 25 miles with main rod up. A.—Place valve in center of travel to cover ports, take out water relief valves in end of cylinders and run at reduced speed.

2. With the high pressure piston head gone, but cylinder head in place, could the engine be run 50 miles in hard service without doing damage to the crosshead or guides? A.—Can be done, but would not be advisable.

3. In case this engine should be run on one side with the back end of main rod disconnected and the crosshead ahead and blocked behind, valve pushed clear ahead and both front cylinder heads off, would she be entirely safe? A.—Yes. Valve should be blocked in center covering both ports and main rod disconnected.

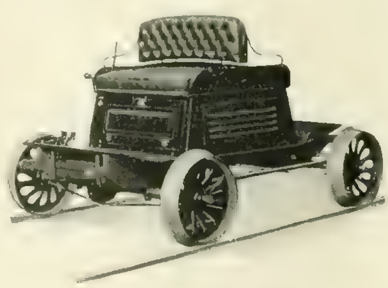
4. Men here claim this engine cannot be blocked securely with wood. How is it? A.—It can, same as single expansion engine.

5. If a Vauclain can pull her train next to center notch, is that not the place to work her? If not, why put the notches there? A.—Should not cut off more than half stroke. If notches are in quadrant between center notch and the notch for half stroke cut-off they should not be used.

(79) J. A. B., Pueblo, writes:

1. How can it be that one engine uses less fuel and no less water than another in the same class of service? Mr. Stewart, of the U. P., at the traveling engineers' convention, in Chicago, stated that a Vauclain compound cutting off at 7 or 8 ins. is no lighter on water but lighter on fuel and that the flues last longer. A.—As Mr. Stewart did not produce statistics to prove his assertions, we assume that it was merely his personal opinion. The heating surfaces of the Vauclain compounds may possibly be greater and better proportioned than the simple engines he refers to, which would give them a greater evaporative efficiency for the same quantity of coal consumed. Piston clearance, leaks about the boiler, carrying a high water level and working wet steam are all factors to be considered. With the softer exhaust of the compound the life of the flue should be prolonged. Conditions must govern both cases.

2. Is there any truth in the statement often made by engineers that an engine once blown up or burned will be hard on coal and water? A.—None whatever, if there is enough left after the explosion to put her in her former condition.



AUTOMOBILE INSPECTION CAR.

(80) W. S. B., Quebec, writes:

The Quebec & Lake St. John Railway some years ago bought two consolidation engines at Kingston. Two pairs of drivers were under the fire box and gave considerable trouble. Later the M. M. removed the rear driver. A says that the engines lost some of their tractive power, while B says there is no change. Who is right? A.—If in removing the rear drivers the weight was equally transferred from the rear drivers to the remaining drivers, the tractive effort remains the same, and the engine should do better work when once under way, as there is less resistance from friction due to the removal of one pair of rods and wheels. The fewer driving wheels an engine has the better for free working. If there is weight sufficient to keep them from slipping, one pair of drivers is most desirable.

Automobile Inspection Car.

A very interesting example of the application of the automobile motor to commercial and industrial uses, is seen in some new productions of the Olds Motor Works, of Detroit, Mich., whose well-known runabout, the Oldsmobile, has for the past three seasons proven by far the most popular machine of its weight and type made.

While the Oldsmobile is light in weight, its motor is unmatched for power and strength, and it is this feature of the machine that brought it successfully through the recent ordeal of its journey from San Francisco to New York, without an accident of any kind.

The regular 4½ h.p. motor of the Oldsmobile has been used in making a new Railway Inspection Car. The motor has been mounted on a suitable frame and equipped with four 20-in. pressed steel car wheels of very light construction. The axles and underframe are of cold-rolled steel, with outer casings of number 11 gauge steel tubing. The motor, which is the standard runabout engine of 4½ ins. bore by 6 ins. stroke, is fitted with the regular two-speed-ahead-and-one-reverse transmission. It will carry four people comfortably, and will ascend any grade, up to the point where traction fails.

This machine is sure to prove very valuable in railroad service. It will travel from 80 to 100 miles with one filling of the water and gasoline tanks, and will reach a speed on ordinary levels of 35 miles an hour.

Some improvements have been made on the Olds motor that promises to give it still greater effectiveness. It has been lightened by reducing the water jacket to about one-half the length of the cylinder. Heat radiating flanges are now cast on the lower half of the cylinder in place of the water jacket, which covers only the combustion chambers and the travel of the piston head. The changes are not radical, and in all other respects the motor is the same one that has carried the Oldsmobile to its present high standing in public favor.

Another successful application of the Oldsmobile motor to the world of commerce is in the production of the new Oldsmobile Light Delivery Wagon which has just recently made its appearance on the market.

Its general construction is that of the famous runabout which has preceded it. It has a longer body, and carries a box measuring one cubic yard inside. It measures, over all, 8 ft. 2 ins., is 5 ft. 2 ins. wide, and is 6 ft. 8 ins. in height. The wheel base measures 6 ft., and its tread is 4 ft. 7 ins. The wheels are of the artillery type, and are equipped with 28x3 in. detachable tires.

I hold every man a debtor to his profession; from the which as men of course seek to receive countenance and profit, so ought they of duty to endeavor themselves by way of amends to be a help and ornament thereunto.—*Bacon.*

Air-Brake Department.

CONDUCTED BY F. M. NELLIS.

The Engine Truck Brake As a Hindrance to Curving.

In the past few months considerable discussion has been had regarding the air brake on the engine truck hindering the curving of the locomotive. As one or two instances have occurred in fast train service where the engine has failed to keep the rail, and gone off the track on a curve while going at high speed, considerable adverse comment has been made on the truck brake, the charge being made that when the truck brake is applied the truck is held rigid and not given the proper freedom which it should have to properly follow the curve of the track. A little deliberation and logical examination will prove that these objections are unfounded, and that the truck brake is entirely innocent of any of these charges made against it.

The truck brake is wholly self-contained; that is, the brake cylinder, all of the rods and levers, etc., with the exception of the flexible hose connection, have no outside attachment whatever to the engine frame or elsewhere, and are contained wholly within the truck frame itself. If the pull on the levers were from some point back of the truck and outside of it, there might, possibly, be debatable grounds for accusing the brake of hindering the engine truck in adapting itself to curves in the track. However, actual service has proven even this to be untrue.

To illustrate the self-contained principle of the truck brake, we might compare it with a man lying on his back on the floor with his knees under his chin, feet extended, and tugging at his boot-straps. In this position, if a person were to attempt to whirl around in a circle the doubled-up man while pushing his feet into his boots, they would find that it could be as easily done as though the man were to release the tension on his boot-straps. This is an example of a self-contained pull from the inside, and none coming from the outtside. Coming nearer to the actual case, we might place a locomotive upon its back, wedge the truck brake shoes tightly against the wheels and then spin the truck and its frame on its center bearing around on the center casting. Then we might remove the wedges, allowing the brake's shoes to be free from the wheels, and again rotate the truck around the center casting, and it would, of course, be found that the ease with which this rotation was made was the same in both cases. Hence, it will be seen that where the brake pull comes from within the truck itself, there is no hindrance whatever to the truck wheels adjusting tthemselves to suit the curving of the engine, and the truck will faithfully lead the engine around the curve.

The hindrance of the air brake to the leading wheels of a vehicle in curving is disproved in the electric car, which goes easily around very sharp curves. The truck has the same connection through its center casting to the car body that the engine truck has through its center casting to the engine frame. However, if the locomotive or car is running at a very high rate of speed, and the curve is not properly elevated on the outside rail, the natural tendency of the wheel is to mount the rail and jump the track; and improper elevation of outer rail may be sufficient to permit it to do so, especially if the flanges of the wheels are in a worn and sharp condition. But, with wheel flanges in good condition, proper curve elevation and the center bearing of the truck sufficiently free to permit the truck to easily turn, there should be no trouble from this source.

H. C. FRAZER, A PIONEER AIR BRAKEMAN, RECENTLY DECEASED.

In looking back to the days before truck brakes were applied to engines we find certain instances of where a center casting fitting too snugly in the center bearing of the truck frame caused engines to climb the rail and wreck themselves. Hence, it would seem a very logical conclusion that the objections above referred to are wholly without fact or foundation.

Hocking Valley R. R. Instruction Car.

In keeping with the spirit of progress, the Hocking Valley Railroad has recently built at their shops in Columbus, O., from designs made by Mr. S. S. Stiffey, superintendent of motive power, an elaborate, up-to-date instruction car, which contains all the apparatus necessary to demonstrate thoroughly the workings of the air brakes, steam heat, injectors, lubricators and other attachments usually found in modern railway service, and it is to be used for the purpose of instructing the employes of this system in the correct method of caring for, operating and maintaining these devices.

In the accompanying illustrations of the car, view No. 1 shows the exterior. View No. 2 shows the interior, looking toward the office and reception room. The brakes are operated by the engineer's brake valves, either Westinghouse or New York, as desired, both of these types of brakes being used on this system, and they are shown located in the end of the car, mounted on the main reservoir. The freight brakes, 18 in all, consisting of 9 Westinghouse and 9 New York equipments, are located on one side of the car, while the passenger brakes, consisting of engine, tender and passenger coach equipment, are located on the other, thus leaving a large space between the equipments in the center of the car for the accommodation of the classes.

The brake valves are so piped that the apparatus may be operated by either the Westinghouse or the New York, by simply cutting out one or the other. To each engineer's valve there is a sectional valve of the same type, connected in tandem, so that the student can see just what each valve is doing in each position of the handle. The triple valves also have sectional models working in tandem with them, so that their operation may be easily seen and understood. Sectional parts of all air brake valves, steam valves and lubricators used on the system, are conveniently located in different parts of the car, where they may be examined and their construction studied.

Five large charts of the New York quick action triple valve, showing its different positions while in action, adorn the sides of the car, and are hung just above the passenger equipment. The train air signal piping is attached to the roof, where it may be conveniently operated and yet not be in the way.

View No. 3 shows the interior of the car, looking toward the other end, in which the Fairbanks and Morse air compressor, which furnishes the compressed air to operate the brakes, is located. A gasoline engine operates the compressor, so that there is no necessity for a boiler or a coal and water storage. View No 4 shows the office and instructor's room, with upper and lower berths for the accommodation of those in charge.

The piping for the brakes is the same in length as that found on an ordinary train of 18 cars, and is so arranged that all angle cocks and cut-out cocks may be conveniently manipulated in the same manner that it is done in actual service on the road, and the whole or any desired part of the brakes operated at will. By this means all the peculiar operations of the brakes, due to cutting in cars with defective triples, or cutting them out, as well as the effect produced at the brake valve on the train pipe exhaust by different lengths of train pipe may be shown. The whole interior arrangement of the apparatus is convenient and compact, utilizing all available space in such manner as best to serve the purpose for which the car is intended, which reflects much credit on the ability of the designer.

The car is in charge of Mr. L. C. Engler, general road foreman of engines, who is assisted by Mr. H. H. Hill, assistant road foreman of engines, and Mr. W. H. Wiley, traveling fireman. The car will be kept in operation all the time over the 1,100 miles of road owned and operated by the Hocking Valley Company, and will on those lines, as similar cars have done on other lines, prove a great benefit to the employees, and a paying investment to the company.

NO 1.—EXTERIOR VIEW OF THE HOCKING VALLEY AIR-BRAKE INSTRUCTION CAR

To the young this is a world of action, not for moping and droning in.—*David Copperfield.*

CORRESPONDENCE.

Don't Push the Cork In.

Considerable trouble is being had from the high-speed reducing valve, which arrives at the shops here with a small cork in the vent hole in the adjusting screw cap. Very often the cork is pushed in until the flat head is flush with the metal, and is very hard to dig out. The man putting up the valve will take a stick and poke the cork through the hole, inside of the cap. The cork will ofttimes fall back into the hole, stopping it as completely as if it had been driven in. This allows the brake cylinder pressure leaking past the piston to store up in the spring case and assist the spring in pushing the valve upward. Cases have been found where the brake would release much quicker than it should, and have been found to be due to the cork stopping up the vent hole in the cap. AMOS JUDD.

Boston, Mass.

An Automatic Retaining Valve.

This automatic retainer is composed of (1) a diaphragm, (2) a winged check valve, and (3) an adjustable spring set to balance the auxiliary pressure as exerted on the diaphragm.

Its operation is as follows: Set the spring to balance one or two pounds over trainline pressure. Charge up the brake cylinders to whatever pressure is needed to control the train on a down grade, recharge trainline by placing the valve in running position, and the retainer will hold all the pressure that is in the cylinders. Now, brakes charged, auxiliaries recharged, pump resting rolling down grade, what more is wanted? To release, throw some excess pressure into trainline and raise auxiliary pressures the one or two pounds needed to overcome the spring and brakes will come right off.

I claim for this device as follows: Absolute safety, as it is impossible to loose control of the train. Great economy, as it saves air and pump wear. Increased braking power, as there is always full pressure in the main drum and auxiliary. Besides this, the brakes are free whenever so wanted. There is no delay in cutting out retainers at stations or level places, and no risking the lives of brakemen climbing over icy cars on dark winter nights, turning up or down retainers as now. V. BERGENHEIM,

Oakland, Cal. Sou. Pac. Ry.

QUESTIONS AND ANSWERS

ON AIR-BRAKE SUBJECTS

(83) R. J. L., Philadelphia, Pa., asks:

Which will hold the best, a brake shoe six inches from the rail or one twelve inches? I mean that many inches from the top of the rail to the middle of the shoe. Also, the same pull on each shoe. A.—If there is no difference in conditions except in the height of the shoe from the rail, the one ten inches above the rail will have a greater holding effect. The shoe pulling nearest to the center of the wheel is the best holding shoe. The lower hung shoe pulls farther from the center of the wheel, and will therefore produce less retarding effect.

NO. 2.—AN INTERIOR VIEW OF THE HOCKING VALLEY AIR-BRAKE INSTRUCTION CAR.

(84) A. B. L., Lexington, Ky., asks: Why don't they put a collar on the lower end of the piston rod of the air pump, thus giving a broader shoulder or bearing surface for the piston head? The bearing is so narrow that when the head works loose on the rod, the pounding of the head against the narrow

shoulder will wear a big hole in the head and let the rod slip through. A.—The trouble is not in the narrow shoulder, which is wide enough if lost motion is kept out, but is due to the

NO 3.—INTERIOR VIEW OF THE HOCKING VALLEY AIR BRAKE INSTRUCTION CAR, LOOKING DOWN THE AISLE WAY TOWARD THE COMPRESSOR.

nuts not being screwed up tightly and securely, and the head is not held tightly against the shoulder. A little lost motion will be left which grows and increases until the head is slipping back and forth on the rod, finally wearing through if not properly attended to.

(85) B. McC., Louisville, Ky., asks:

If a retainer holds 15 pounds in the brake cylinder, and you recharge to 70 pounds, and you apply the brake in emergency, will the retarding force be greater than the force against the rail of a freight car? A.—The final brake cylinder pressure, after 15 pounds has been held in the cylinder by the retaining valve, the auxiliary reservoir re-charged and brakes reapplied, would be but a few pounds higher than if the brake cylinder were empty, and a similar application of the brakes had been made. The pressure of the brake shoes against the wheels would not be sufficient to cause them to slide, and would be but a slight increase over the application made with the retaining valve turned down.

(86) E. J. H., Wilkesbarre, Pa., asks:

Does the length of the sound of the train pipe exhaust at the brake valve always tell the number of cars in your train? In other words, if the blow at the valve is longer at one time than another, does it always follow that there are more cars in the train, even though the blow may not be as loud in one case as in the other. A.—As a general rule the longer the blow at the angle fitting the longer the train, providing the blows in both cases sound about alike; but if one discharge is rather weaker than the other, and the length of time of discharge the same, it would indicate that there is ice or other foreign substance

NO 4 THE OFFICE AND SLEEPING ROOM OF THE HOCKING VALLEY AIR-BRAKE INSTRUCTION CAR.

forming an obstruction in the hose or the train pipe somewhere.

(87) A. B. L., Lexington, Ky., writes:

Why wouldn't it be better to make the air end of the piston rod larger and [illegible] It would be stronger then, and would not break as easy as it does now. There are a lot of engines that break the nut off the rod right where the thread stops. A.—If the nut is screwed up tightly and securely locked so there is absolutely no lost motion between the nut and the piston, the piston rod will be found to be large and strong enough. The usual cause of the breakage of the rod at the point described is the screwing up of the nut with a chisel when the piston is in the cylinder. This damage is frequently done in the round house by the running repair man, who resorts to a hammer and chisel after finding the whole piston turns when a wrench is used on the nut.

(88) R. M. [illegible], Buffalo, N. Y., writes:

There is a general belief among some of the engineers and firemen that the engine truck brake hinders the engine in tracking or curving, and that several instances, where the engine has left the track, that the truck brake has been responsible for the engine climbing the rail on the curve. What is you opinion of this? A.—As it is a fact that the truck brake is self-contained, and has no connection to the engine frame, it cannot, therefore, have any influence on the engine curving. However, if the truck brake shoes received their pull from some backward point on the engine frame, it might be possible that such arrangement would, in a degree, hinder the truck somewhat in curving; but as all connections are centered in the truck itself, there can be no real cause for accusing the truck brake of causing the engine to climb the rails.

(89) R. J. L., Philadelphia, Pa., asks:

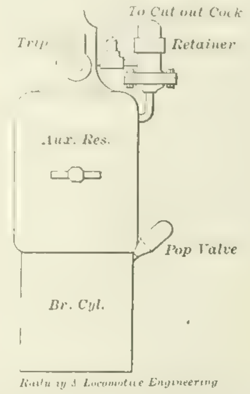
Which is the best brake, one that is hung outside of the wheels, or one that is hung between the two wheels? Why? A.—Generally speaking, the inside hung form is more advantageous. A better length of hanger can be used without causing the brake shoes to be lowered close to the rail. Thus the shoe cannot climb up the wheel and the short hanger allow a wedging action which will tend to slide the wheel. The inside form does not permit to the same extent the tilting of the truck and the consequent jolt to the train in stopping, as does the outside hung. The inside hung form is sometimes more troublesome to fit with new brake shoes, due to the interference of some of the outside parts of the truck frame. Again, the inside hung form does not require the stiff release springs which too frequently find their way on the outside form.

(90) C. E. H., Philadelphia, Pa., asks:

If an engine is equipped with two air pumps, should two governors be used, or would one operate both pumps? A.—Where two air pumps are installed on an engine, two air pump governors and two lubricators should be supplied separately for these pumps, if a complete duplication of pumps is desired. If one pump should become inoperative, from any cause, there would be another entirely separate machine, and its attachments to carry on the work. If this duplication of parts is not complete there will not be two separate machines, and in the event of the breaking down of the governor, the purpose of supplying a second pump will be defeated. On the other hand, if it is desired to have both pumps running all the time, dividing up the work evenly, the arrangement of one governor, or one set of tops and two bodies, would answer the purpose better. There are engines equipped both ways, and doing the work satisfactorily in the way intended.

(91) H. H., Victoria, British Columbia, writes:

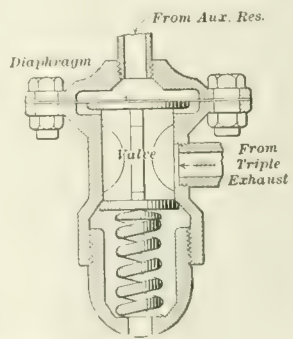
I would like to know what the gauge is like which is attached to the engineer's brake valve for recording emergency applications. A.—The gauge part is about three inches in diameter, and is graded, or divided, into parts like a steam or air gauge; but instead of pounds pressure, the gradations mean the number of emergency applications made. The gauge is operated by a device which consists of a piston, having on the end of its rod an attachment which notches up in the same manner that the mileage is recorded on a bicycle recorder. The whole attachment is fastened to the back of the brake valve, where the air comes from the train pipe when an emergency application is made. On each emergency application the air strikes this piston, and drives it inward, causing the recorder to register up one notch at a time. Each of these emergency applications is thus shown on the gauge, and goes against the man operating the brake valve.



NEW DESIGN OF AN AUTOMATIC RETAINING VALVE, THE VALVE ATTACHED TO THE CYLINDER.

(92) R. O. F., Philadelphia, Pa., writes:

We have an engine here that is piped with double topped governor. The low-pressure head was set in the shop for 90 pounds, and the high pressure head for 110 pounds. The connection to the high-pressure head is tapped into the main reservoir pressure at the brake valve, and the low-pressure top is connected to the under side of the brake valve. It does not matter in which position the brake handle is placed, the pump will not stop until 110 pounds pressure has been pumped up, when the high pressure governor head operates. We have taken off the low-pressure head connection, and find no air coming through at all. Please say what is the trouble. A.—Doubtless there is some obstruction between the feed port in the brake valve into which the low-pressure head is tapped and the governor connection, else air would flow from the pipe when disconnected at the governor. Possibly the gasket in the lower part of the brake valve has not been cut away, thereby blanking the port which should supply air to the low-pressure head. Possibly, again, there is a stoppage in the pipe itself.



DETAILED PARTS OF A NEW AUTOMATIC RETAINING VALVE.

(93) J. McT., Chicago, Ill., writes:

We had a passenger train leaving Chicago on our road on which the brakes would set and release alternately. In one case the train was brought to a standstill before the brakes could be released, and then a bad leak was found in the hose coupling between the tender and first car. The track at which point this occurred was very uneven and rough, being a portion of track that was being elevated, and was lying on a loose, sandy foundation, making numerous dips and rises. Could this rough track have anything to do with the brakes going on? A.—Yes Doubtless your trouble was occasioned by undue stretching of the draft gear and air hose couplings between the engine and tender, and perhaps between the cars also, caused by the track being so rough as to allow the train to be pretty badly twisted and thrown out of line, and as soon as the bad point was passed, the draft gear and hose couplings would resume their normal position, stopping the outflow of air from the couplings, and permitting the brakes to release. Inasmuch that this trouble did not appear on any other track than the very rough track mentioned, this explanation would seem a logical one.

(94) S. H. W., Meadville, Pa., asks:

What is the small plug for that is on the under side of the brake valve near the main reservoir connection? Where does the port lead to that this plug taps into, and what is the object of the plug? Is it a gauge connection or what? A.—This plug fills a hole which is tapped into the port which conveys main reservoir pressure from the rotary valve seat to the feed valve attachment. The object of this plug is to furnish a connection to the top of the low pressure, double topped governor in freight service. This low-pressure governor top is set for 90 pounds. When the valve handle is in either full release or running position, there is main reservoir pressure in this port, and the governor will shut steam off the pump when 90 pounds pressure has been reached in the main reservoir. When the valve handle is on either lap position or application positions, this port is not in communication with the main reservoir, and the low-pressure governor is, therefore, cut out. Thus, a main reservoir pressure of 110 pounds main reservoir pressure may be accumulated during brake application to insure release of brakes on a long train, and yet the pump is not obliged to continually work against a higher pressure than the normal pressure of 90 pounds at other times.

(95) C. C. B., Cape Charles, Va., writes:

What should I do to make a 9½-inch Westinghouse air pump have more speed? Our pumps, after overhauling them the first time, usually run about one-third slower, while charging up the main reservoir, when first starting, and, in fact, all the time. Our new pumps will charge up in two minutes, while it takes the repaired pumps three minutes. Please tell me how to overcome the trouble. A.—There are three principal things that will cause a pump to run slow, viz., restricted steam passageways, whereby the steam pressure goes too slowly to the air piston; choked exhaust, causing exhaust steam to escape slowly, and too small lift of air valves or suction inlets, which prevents air from getting into the air cylinder as quickly as it should. Possibly some of the ports in the pumps are partially closed by gaskets lapping over the steam ports. Again, possibly the lift of your air valves is insufficient, or the passageways in the pump are clogged up with burned oil, due to lubricating the pump through the air valves. A lye-bath of the air cylinder and ports would remedy the latter. Possibly the pump will make as many strokes per minute after it is repaired as before, but will not pump up the pressure with the same number of strokes. If this is the case, the trouble is probably due to the fitting of new packing rings in a cylinder without reboring the cylinder, thus permitting the rings to fit only at mid-stroke, and be loose at both ends of the stroke, where the cylinder is worn larger.

(96) R. M. E., Buffalo, N. Y., writes:

A number of our Atlantic type passenger engines have a truck brake on the forward double truck, on the driving wheels, and on the trailing wheels behind. That is, all wheels on the engine are braked. I note that when the engine comes to a stop at the station with a train, the trailing wheels pick up and slide. This looks as though the engine truck brake pulls the forward end of the engine down, and allows the rear end to raise up behind, causing less weight to rest on the trailing wheels and results in sliding. Would it not be advisable to reduce the braking power of the truck brake for this reason? A.—Inasmuch that the truck brake is self-contained; that is, the cylinder and all the truck brake parts are on the truck frame, and not on the engine frame, and have no connection whatever with any other part of the engine excepting the rubber connecting hose, it would be impossible for the truck brake to pull the forward end of the engine down. It might be possible, however, that the engine, having very high wheels, and standing very high in the air, is top-heavy, and has a tendency to do a summersault when coming to a stop, thereby lowering the front end of the engine and raising it behind. This would cause the rear trailing wheels to slide. If this be true, the better plan would be to reduce the braking power on the trailing wheels to prevent them from sliding, rather than reduce the braking power at the engine truck brake.

(97) G. W. K., Washington, D. C., writes:

A class of engines here are piped in a way that the train signal reducing valve feeds into the signal pipe back of the signal valve, or between where the signal valve is connected and the cut-out cock on the tender. If the reducing valve is in good condition, it is impossible to get a long blast of the whistle, and it requires a neat fit of diaphragm stem in the bushing in order to get a blast of the whistle on six or seven cars. Is this method of piping right? A.—The method of piping described is not the best obtainable, and a better method would be to have the pipe to the signal valve tee off the main pipe at a certain point, then off this branch pipe to the signal valve have another branch pipe tee off to the reducing valve, which should be located a foot or two at least from the pipe leading to the signal valve. Then to the opposite side of the reducing valve have the supply pipe connection made to the main reservoir. With this method of piping the signal will respond equally well whether the engine be going ahead pulling a train, or backing up pulling the train. The diaphragm stem should be an easy, though neat, fit in the bushing at all times in order to insure a good signal at the whistle. If this stem becomes too loose, it will supply signal pipe leakage better, but will not be near so sensitive when responding to a blast made at the discharge valve in the car. It might be well to observe that the discharge valves in the cars of the train are perfectly free and open, and a strong, sharp exhaust is had each time the cord is pulled.

(98) J. E. L., Savannah, Ga., writes:

What kind of oil, and how much of it should be put in the air cylinder of the air pump? Some instructors say to put no oil in the air cylinder until the piston begins to groan, but to let the swab on the piston rod do the lubricating. A.—A good, substantial bodied oil, such as high-grade valve or cylinder oil, should be used in the air cylinder, and put in through the oil cup. While an oiled swab should be kept on the piston rod, additional lubricant will be needed as described, especially now when the pump is required to do greater work on longer trains than formerly on short trains. The condition of the pump and the service it is in must determine the amount of oil used, good judgment being exercised to discriminate between flooding and stinting in the supply of the air cylinder lubricant.

(99) M. R. R., Rutland, Vt., writes:

On an engine equipped with the G-6 brake valve, the train line gauge hand will show 90 pounds the same as the main reservoir gauge hand, when the engine is not coupled to a train and the brake valve handle is in running position, where they ought to be 70 and 90. But when the engine is coupled to a train of 30 or 40 air-braked cars, and the handle is put in running position, the train line and main reservoir hands will stand at 70 and 90 all right. What makes this difference? A.—Either the rotary valve, or the supply valve in the feed valve attachment, or both of these parts, may leak sufficiently to allow main reservoir pressure to escape into the train line and equalize, and show on the gauge. On the lone engine the leakage is sufficiently great, in comparison with the short length of train pipe, to bring about this equalization rather easily. On a train of considerable length, however, the train pipe volume is very much greater, and the leakage past the defective parts described being the same in amount, will be lost in the larger train pipe volume.

(100) M. R. R., Rutland, Vt., writes:

When a reduction is made at the brake valve on a lone engine, and the brake valve handle is put to full release to let brakes off, there will be a flash and a long blow of air at the train pipe exhaust. It only acts this way on the engine alone, and will not do it when the engine is coupled to a train. The piston seems to raise up and cause the blow, but why don't it do it on a train, too? A.—With the light engine the brake valve in release position will, on account of the larger port, admit pressure from the main reservoir into the train pipe on the under side of the equalizing piston more rapidly than on the top of the piston, where a smaller port leads. Therefore, the piston will rise and flash. However, when the engine is coupled to a train, the greater volume of train pipe will absorb the pressure coming from the main reservoir to the train pipe. This prevents the backing up of pressure under the piston, and the consequent flash at the brake valve.

We would again urge our correspondents to send their letters and contributions to us as early in the month as they can, as the air-brake department goes to press earlier than some other parts of the paper. Each month we are obliged to hold over matter coming to us too late for the current issue. Correspondents should also send full name and address for our private use.

Apparatus for Drilling Stay Bolts.

The accompanying illustration shows a handy apparatus for drilling the small tell-tale holes in the ends of stay bolts, which many railroads require to be done when buying new equipment. It is used in the Pittsburgh shops of the American Locomotive Company.

The apparatus consists of an upright plank 1½ ins. thick, hinged at the bottom upon a 1½-in. round iron rod which lies just above the floor level, and upon this rod the plank can slide so as to stand opposite any portion of the fire box sides or end. The long upright plank is held at the top by a cord leading to a small weight. The cord passes over a pulley which revolves upon a shaft held at each end by temporary

APPARATUS FOR DRILLING STAYBOLTS.

brackets. The pulley also slides along this shaft as the board is moved along the side of the fire box. The board for drilling stays in the end of the fire box has a counter weight pulley which can swing on a pin that fits the socket of a dome stud. The plank also carries a smaller one, made out of 1-in. stuff and perforated so as to hold the end of a small drill. The drill is also similarly counterbalanced with cord and pulley so that the workman is not fatigued by constantly supporting the weight of his machine, and is thus enabled to devote his entire attention to the accurate performance of the work in hand. The plank can be drawn back, or pushed toward the fire box at the top so that the required angle for the drill is easily got, and as the weight of the board is practically balanced, very little exertion on the part of the workman is required to hold it as he may require it. The whole rig is very simple and very ingenious, and is a time and labor saver in the shop.

What Came of Trying to Save the Expense of Washing Out Boilers.

About four years ago a Supt. M. P., on a transcontinental line, issued an order for a bad-water district, that the boilers were now equipped with a sufficient number of blow-off cocks, and that the frequent washing out, which had previously been resorted to, must be discontinued. Conditions were such that boilers had to be washed every other trip in order to make successful trips. At each end of the line the hostler filled up the boiler and blew down two gauges. After a month's trial, during which period the boilers had received two washouts, it was found that it required a constant water pressure of 125 lbs. and of four hours' duration to dislodge the scale and mud that had accumulated at the throat-sheet before any water got to the leg of the boiler. Nor was this all the trouble. Trains were delayed by engines foaming, flues began to leak, and engines died on the main line, blocking traffic. The manufacturer was unjustly condemned and accused of furnishing inferior flues, and the engines, having seen only 60 days' service, had to have their flues removed, while, with the old method of washing out, the flues generally gave from 5 to 7 months' good service. The engineer came in for his share of condemnation and was accused of trying to down the S. M. P.'s pet engines.

For many years engineers cared nothing about the theory of the steam engine. They went on improving and developing it without any assistance from men of pure science. The most important improvements carried out on the engine have originated from the unaided good sense of the practical men. There are certain things which science ought to have predicated, such as the economy of compounding, which were left to practical men to carry out. But as soon as the advantages were demonstrated science theorists rushed forward to make explanations. If scientists would fall into the way of giving help before the practical man had surmounted the gradients opposing success in carrying out improvements it would profit the industrial world more.

A short time ago the oceam tramp steamship *Arara* sailed from New York with one million dollars of new silver money for the Philippine Islands. There was a special guard with this shipment and the vessel carried two rapid-fire 3-in. guns and some smaller ones. In her cargo were twenty-five old locomotives from the Manhattan Elevated Railway. They have been refitted and are in good shape. They have been painted a bright yellow, with large Chinese characters on their sides, which indicate the name of the foreign railway which now owns them. New Yorkers who have been familiar with the soberly colored little puffers on the "L" road would hardly know them now, dressed each in the coveted "yellow jacket," which is a mark of high distinction in the Celestial Empire.

A correspondent on the Illinois Central Railroad, at Champaign, Ill., writes us: "We have a lot of new engines which are giving some trouble with broken steam chests, engineers having been disciplined by the master mechanic, who claims fractures were caused by working water. We think that the trouble is too little oil. We are allowed 1⅛ pints of valve oil to keep a 20-in. consolidation engine going over a division of 125 miles. We would like to have the opinion of your readers as to the cause of the trouble."

The city of Dunkirk, N. Y., is enthusiastic over a proposal to erect a monument in honor of the late Horatio G. Brooks, founder of the Brooks Locomotive Works. It will, when completed, be placed in Washington Park.

Signals and Signaling.

BY GEORGE S. HODGINS.

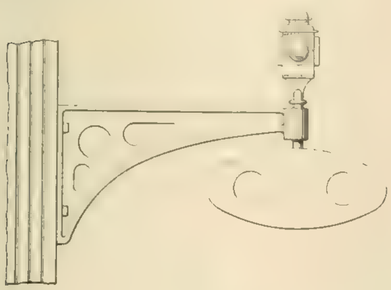
(Continued from Page 528.)

THE BLOCK SYSTEM.

The block system in itself is not a piece of mechanism, and though it requires the use of more or less carefully adjusted apparatus, it is on railroads nothing more than a thoroughly safe

THE DISTANCE OR SAFETY LIGHT ON A TOBOGGAN SLIDE.

method of train movement. In Canada, where one of the popular outdoor winter sports is tobogganing, it is an invariable custom on a properly managed "slide" to have a small pine tree branch stuck in the snow at one side of the track and about half way down the incline. At night a lantern or torch indicates the spot selected. This torch is called the "distance light," and the rule which every one is expected to obey, is that no toboggan shall leave the top of the slide until the preceding toboggan has passed beyond the distance light. The observance of this rule places a certain definite space interval between each toboggan-load of pleasure seekers as they glide down the hill, and this is, in principle, nothing more or less than the block system.



STATION TELEGRAPH BLOCK SIGNAL.

The methods of applying this principle to railroad operation are various, but the end and object of them all is to secure a space interval between trains moving in the same direction. The time interval between trains has been found to be so utterly unreliable and so many serious accidents have happened under time spacing that it is being displaced yearly on an increasing number of roads by the block system.

The simplest form of the block system on a single track road has already been alluded to. It consists of constituting the distance between any two stations, a block, and placing the operators along the line, in telegraphic communication with each other. The method of procedure may be outlined by a definite example. Suppose a train moving down the alphabet line, arrives at station C. The operator at that point notifies the operator at D that a down train is ready to proceed from C. The operator at D signifies to C his understanding of the message, and displays his stop signal. C likewise displays his stop signal and the down train moves on, protected at front and rear by the block signals at D and C. When the train reaches D the information is telegraphed back to C, and the operator there can lower his stop signal as the block between C and D is then clear. On a double track road the down line would be blocked by C as soon as the train had passed that station, and the signal behind the train would be kept at "danger" until D had telegraphed to C the news of the passing of the train at D. This method briefly outlined here is called the telegraph block system.

The telegraph system, which is safe as far as it goes, when nobody forgets, has, nevertheless, several obvious drawbacks. The spacing of the stations may be such that blocks will be of unequal length. A long block separating two shorter ones, would, when traffic became heavy, cause serious loss of time, and perhaps lead to congestion at points least able to cope with it. Even if some particular block was all that could be desired in the matter of length; grades and curves in it might so consume the time of trains as to make it practically as objectionable in operation as an exceedingly long block would be. A station operator in charge of block signals would probably have other duties thrust upon him which would increase his responsibility and at the same time tend to distract his attention from the work of signal operation.

The natural remedy for these defects would seem to be, to increase the number of signal stations, so that blocks more nearly equal in length might be secured, sections where grades, curves or other physical features tended to lengthen the time required by trains to pass through them, could be divided up into shorter blocks, thus preserving safety of operation while naturally increasing the capacity of the track. The appearance of signal towers along the line with men in charge whose sole duty related to the telegraphing of information and the operation of signals, would mark a further development of the telegraph block signal system. The need for some such arrangement as this would foster the introduction of automatic block signals, which have now been brought to a high degree of excellence.

THE POSTS AND WHAT THEY INDICATE.

From the original telegraph block system, by due process of evolution, which it is not necessary to trace in detail, we come to the modern automatic system, and just here it may be advantageous to glance at the signals themselves and see what indications they may be made to give and how they give them. The ordinary form of block signal is that of a semaphore having two arms on one post. One is placed at the top and the other is about six feet lower down, the post being about twenty-eight feet high. The arms usually hang from the post in such a position that when raised they stretch toward the right and away from the track which they govern. The

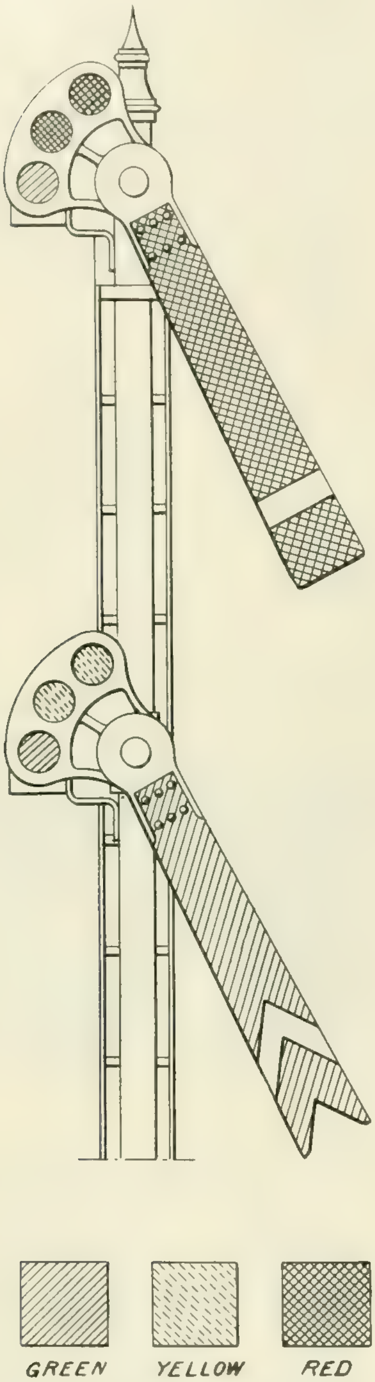
SEMAPHORE ARM WITH POINTED END.

upper one is called the "home" signal, and it governs the block at the entrance of which it stands, and which we may call the block adjacent to the signal. The lower arm is called the "distant" signal, and it relates to the block next ahead, and when once raised, cannot be lowered while the block next ahead is occupied. At the entrance of block A the "home" signal governs block A, while the "distant" signal on the post at A indicates the condition of block B.

The "home" signal is usually painted red, with a white band across it near the blunt or sometimes pointed end, farthest from the post. When hanging at an angle of 60° from horizontal it indicates "all clear," and at night shows a white light in this position. If the new color scheme is used it shows a green

light for "all clear." When at "danger," the arm is extended horizontally from the post, and a red light is displayed at night.

The "distant" or lower signal is similar in shape except that it has what is called a "fish-tail," which is really an acute angled notch cut out of its end. The arm is usually painted green, though yellow is sometimes used, with yellow



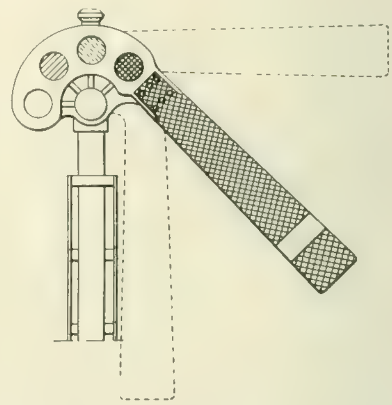
SIGNALS AT "ALL CLEAR" WITH NEW COLOR SCHEME FOR NIGHT.

light at night, according to the new color scheme. It has usually a white band near the end conforming in outline to the fish-tail notch. This V-shaped band resembles the chevron or sleeve badge worn on the arm of a sergeant in the army. On the semaphore blade, as well as on the soldier's arm, it in a measure indicates official rank and authority. As the sergeant has not as much authority as the officer over him has, so the "distant" signal, wearing the sergeant's badge on its arm, has not the same absolute authority as the signal above it has. It acts simply as a warning concerning the block next ahead, while the topmost or "home" signal at "danger" blocks the line where it stands and must not be disobeyed. These signals may almost be said to have, above, the commissioned rank of captain and below the non-commissioned rank of sergeant. The backs of both arms are usually painted white, with a black band corresponding to the white band on the "home," and a black V-shaped band corresponding to the white V-shaped chevron on the other side of the "distant" signal. The shape and coloring here described may and does vary on many roads, but these forms and colors give excellent signals and their use may be described as exceedingly good practice.

There is another form of fixed signal called the three-position or 90° semaphore. When its arm is in the horizontal position and a red light displayed at night, it indicates "danger," as does the two-position signal described above. When the arm is placed at an angle of 45°, accompanied with a green light after dark, it gives the "caution" indication. Yellow would be shown if the new color scheme be used. The absolutely vertical position, parallel to the post, with the display of a white light, or preferably a green light, indicates "all clear." The semaphore signals are fitted with "spectacles" for holding the colored glasses, and these spectacles are so spaced for the two-position semaphores that the "danger" or the "caution" light is continuously displayed until the arm is within 10° of the "all clear" position, and 15° for the three-position signals. This arrangement prevents confusion by the disappearance and reappearance of the light as the semaphore arm moves. It also prevents any possible sagging of the blade due to lost motion in the mechanism, giving a premature or incorrect "all clear" indication.

A yellow light for the "caution" indication and a green for the "all clear" are used on a number of important roads, and the practice is growing in favor. This arrangement is advocated by many, for the reason that when white is the "all clear" or safety color, it is liable to be confused with other white lights, not connected with railway operation. The increasing use of electric lights throughout the country makes such confusion more and more probable. Again, it is urged that the breaking of a red or green spectacle glass would permit the wrongful display of a white light, but that under such circumstances, if yellow be one of the distinctive signal colors, the appearance of the white light would at once give warning that something had gone wrong with the signal lights.

In this connection it may be mentioned that modern semaphores are made with heavy iron spectacle frames, which under the action of gravity will carry the arm to "danger" or to "caution," as the case may be. This provision is made so that should anything go wrong with the track or signal circuits, or should a switch be opened in the block or a rail broken, the arms would assume the horizontal position, and though delay might occur to a train stopped by a defective signal, the safe course in train operation would have been followed. The counter-weighting of the semaphore arm is intended to overcome the possibility of a signal sticking or freezing in the "all clear" position. If the arms did become frozen in the "danger" or "caution" positions, delay and not disaster would be the only consequence which could follow.



THREE-POSITION SIGNAL AT "CAUTION."

There is another form of fixed signal used on railways which is called the Hall automatic disk signal. It consists of a flat case or box somewhat resembling in outline an inverted pear, and showing in the center on one side a large sized circular transparent glass. The interior of the case opposite this glass, all but a smaller circle of plain glass, is painted a strong white color, so that to the enginemen of an approaching train the "all clear" indication appears as a white circle framed in the somber color of the outside case. The "danger" indication is produced by the electric operation within the case of a disk of red fabric stretched on a circular wire frame, which, when swung into the field of view, completely obscures the white background and interposes its red color behind the transparent glass. The "caution" indication is given by the lower signal displaying a green disk, or yellow if the new color scheme be used. The night signals are given by the light from a lamp placed at the top and at the back of the case, and shining through two appropriate openings in either wall. When

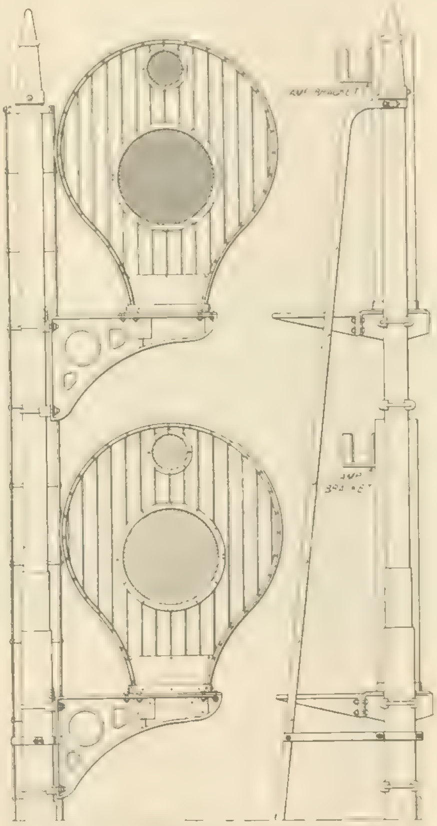
it is desired to give the "all clear" indication, a beam of light is made to pass through the lens of the lamp and unobstructedly through two transparent glasses in the case just above the large circle, used for the day indications. When the red disk occupies the large circle, a red spectacle glass is swung up inside the case which projects a red light toward an oncoming train, thus displaying the "danger" signal. In the back of the case a smaller hole in the center makes it possible for an inspector to see from behind what indication the signal is giving. A small blue glass in the back of the lamp shows, when viewed in the rear, whether or not the lamp is burning. The "caution" indication is similarly given by interposing a green glass in front of the lamp, or yellow if the new color scheme be in vogue.

The mechanism of these disk signals is so constructed that if the electric circuit becomes deranged, or if a switch in the main line is opened or if a rail is broken, these signals, which are usually arranged for "normal danger," will maintain the "danger" and the "caution" position until everything has been made right. The chances of the disk freezing in any one position is obviated by the presence of the weather-proof case which completely encloses the working parts. It is necessary to point out that the disk signal, here described, depends upon the observance of difference of color, both for the day and the night indications.

METHOD OF OPERATION OF THE SIGNALS.

Without at present troubling the reader with an account of the various mechanical devices for electric, gas or pneumatic working of block signals, we will consider briefly the method, or the rules under which the signals are operated. As we have seen in the two-position signals, the upper arm on the post is the "home" signal. It governs absolutely the right to proceed into the block at the entrance of which it stands. The "all clear" position guarantees the safe forward movement of a train, while the "danger" position imperatively demands a stop. As there is no ambiguity in either indication, so there must be no faltering in the obedience rendered. The lower arm is the "distant" signal, and its position has reference to the block next ahead, as it has no jurisdiction over the block adjacent, which the "home" governs. Its indication is cautionary, or as some would say, advisory. On approaching an automatic block signal, information concerning the condition of two blocks ahead is given to the men on the engine. If the "home" and "distant" stand at "all clear," the two blocks ahead are unoccupied. If the "home" is at "all clear," and the distant at "caution," the block adjacent is empty, but the block next ahead is occupied. If both arms stand respectively at "danger" and "caution," a dead stop must be made. The "home" signal deals, as it were, with the present, and the "distant" with the future, and with both against a train, it is necessary to halt. It is not possible, with properly working apparatus, to have the "home" stand at "danger" and the distant at "all clear," on the same post, and the reason for this will shortly appear.

If both "home" and "distant" show "all clear" at block A, the train proceeds, and as soon as it enters block A the signals go to "danger" and "caution" behind it. The "home" remains at "danger" so long as the block A, which it guards, is occupied. When the "distant" has once gone to "caution," as it must, upon the passing of a train, it loses its free will, so



HALL AUTOMATIC DISK SIGNAL.

to speak, and can only assume the "all clear" position again when the "home" signal at B, the block next ahead, has "cleared." In thus going to "caution" when the block adjacent is entered, and being "cleared" only when the block next ahead is empty, the "distant" signal is enabled to give an indication of the utmost value. In assuming the "caution" position it moves with the "home" on the same post, but in "clearing" it acts in unison with the "home" on the post of the block next ahead. It thus indicates the position of the "home" signal at B. In addition to this, the "distant" signal is so constructed that it never can be "cleared" until the "home" signal above it on the same post is in the "all clear" position. It is evident from this whole arrangement that when a train enters the block adjacent to the signals which shows the "home" at "all clear" and the "distant" at "caution," the advisory signal, with the fish-tail blade, says to the men on the engine, "The home signal on the block next ahead is against you, prepare to stop now.'

The three-position semaphore has only one arm on the post, except in cases where diverging line has to be signaled. With this signal, the vertical is the "all clear" position. As soon as a train enters the block adjacent to the signal, the "danger" position is assumed, and when the train enters the block next ahead the arm drops to the "caution" position, and finally "clears" when the block next ahead has been vacated by the train.

With the use of automatic signals, the practice called "permissive blocking" has been generally adopted because if the absolute block was maintained, a deranged signal might cause a prolonged delay of trains and possibly introduce dangerous conditions. In both absolute or permissive block systems, the dead stop is insisted upon, when a danger signal is displayed. There is absolutely no right of deviation from this rule. The danger signal is King and must be unquestioningly obeyed. The permissive system recognizing the fact that the danger indication may be caused by a signal out of order, sanctions the forward movement of the train against that signal, but only after a definite time interval has elapsed, during which the train has stood still. This time limit is usually one minute, after which the train may proceed under control. The men on the engine are also expected to look out for obstruction on or derangement of the line. If the block be found unobstructed and apparently normal, and if the block beyond is "clear," the train may proceed at its usual speed, and a report of the condition of signal and block must be sent from the first telegraph station reached.

The absolute block is maintained at all interlocking plants, as it is obvious that no amount of careful flagging or cautious train movement could in any way alter the positions of switch points open, or derails closed, nor could it have any effect upon a swing bridge standing at right angles to the track. On some roads all the absolute block signal arms are painted red without being relieved by the small band of white or black usually found on the arms of the automatic electric block signal semaphores. Permissive blocking may, if desired, be indicated by a semaphore arm having a pointed end.

(To be continued.)

This world is not an utterly miserable one, with all its faults.—*Barnaby Rudge.*

Break-Downs.

BY JOSEPH A. BAKER.

16. BURST FLUE.

Generally in a case of this kind the engine is dead in a very few minutes. Draw the fire and in freezing weather open blow-off cocks, let out all of the water, take down hose connections between engine and tender and be prepared to be towed in. Do no disconnecting and oil cylinders in freezing weather with light oil. With the extension front end of to-day it's next to impossible to reach a flue without removal of draft plates, and the time consumed would not justify repairs on the road.

With leaky flues the conditions are different. Most injectors of to-day have the heater cocks so arranged that they can easily be removed. If bran or sawdust can be had, start the injector first, then take out the heater cock and put a small quantity of the bran through this opening while the injector is working. The current will carry it to the boiler without any difficulty. Too much bran will cause the engine to foam. By this method you can bring in a full train without any further trouble. Gauge and water glass cocks must be opened often, however, to keep from clogging.

17. BROKEN EQUALIZER OR STAND.

If an equalizer post or equalizer breaks run the back wheels up on a frog and block between the main driving box and frame. Next put the frog at the main driver and run main driver up on the frog and block between box and frame on rear driver. Take down all loose parts that are liable to give trouble and run slowly as the drivers will heat very fast otherwise.

18. SPRUNG LINK.

On certain classes of engines with a 4-wheel truck and the lever in the extreme forward notch the links are in such close proximity to the truck that invariably from any cause of derailment the links are generally badly damaged or sprung. With the solid link you have no other alternative but to disconnect the valve gear. With the sectional link unless too badly damaged, slack off the nuts on top and bottom of link bolts, partly withdraw the bolts and insert a washer of sufficient thickness to allow the free movement of link-block in the link when reversing the lever. Tighten bolts again and you are free to go on with your train without disconnecting.

19. DISCONNECTED OR BROKEN THROTTLE ROD.

This depends entirely upon the nature of the break. With a throttle valve open reduce the steam pressure down to a point where you can handle part of your train without slipping your engine. It is always safer to have some cars in your train to get the benefits of the brakes than to run in with just an empty engine. Sometimes what is considered as a disconnected throttle valve proves to be a cocked valve. If the rod connections are badly worn and a full throttle opening given, a cocked valve often results, and is mistaken for a disconnected throttle. Tapping the throttle rod will bring it back, with a closed throttle valve, conditions on your line must govern your actions. On a line burdened with frequent trains arrange to be towed in without disconnecting any part of the engine. If your line requires you to make repairs, blow off the steam, remove dome cap and make repairs. Generally you will find it a bolt that has worked out. Your oil pipes will not supply sufficient steam to bring in the engine of to-day.

20. BROKEN WHISTLE STAND.

A broken whistle stand means a dead engine. Remove the broken part from the dome. A handy thing to have around an engine is a washout plug and several sizes of reducers. In the absence of a washout plug use the reducer in the dome cap, then take the nipple and angle cock off of an air-braked car and insert into the reducer. This takes but very little time and I have seen an engine under steam again in thirty minutes. You can't rely on wooden plugs.

21. BROKEN DRAW BAR BETWEEN ENGINE AND TENDER.

Do not attempt to pull a train with the safety couplings, unless the grade is in your favor. If a chain can be used, insert the link in the deck bolt pocket for draw bar and secure the other end to body bolster of the tender, taking out all of the slack between engine and tender.

22. BROKEN REACH ROD OR LEVER.

Block over one link only with a point of cut-off that will enable you to start your train and maintain a slow speed. With some classes of engines you can use a bar under the lifting arms of the tumbling shaft by placing the bar across both frames, and not block the link.

23. BROKEN TUMBLING SHAFT LIFTING ARM.

Use same manner of temporary repairs as for broken link lifter.

24. BROKEN LINK SADDLE PIN.

Use same method as for broken link lifter.

25. BROKEN LINK BLOCK PIN.

Disconnect valve stem and cover steam ports. Don't disturb main rod.

26. BROKEN VALVE SEAT.

Place the engine on the quarter on the side you think it is on, set your brakes and give her steam with lever in forward and back motion so as to admit steam to each end of cylinder alternately. If the blow is at one end only it indicates a broken valve seat or section broken out of valve. Disconnect the valve stem and move it central if it is a broken bridge between the steam and exhaust cavities. If it is the section between the supply and steam port move the valve in the opposite direction, with the cross-head and piston in the same direction of the valve. This closes the exhaust and admits the steam under full port pressure against the piston. Disconnect main rod. With a valve badly broken, remove the valve and block on the top of steam ports with sheet iron and wood at your command. With a balance valve where the space between the valve and valve table is from $\frac{1}{16}$ in. to $\frac{1}{8}$ in., use sheet iron on the face of valve and blocking at either end. Take out cylinder cock valves and leave main rod up. For a broken piston valve if the break is not a bad one shift valve enough to stop the blow and clamp valve stem at one end and extension rod at the other end. Where there is no extension rod, block between valve and forward head.

27. BROKEN CENTER CASTING.

If the truck is a standard 4-wheel truck a short rail put across the top of the truck equalizer and under the center casting will bring you in safely, or in the absence of rails, block with hard wood blocking over truck frame and under cylinder saddles. Run slow and carefully.

28. BROKEN DRIVING AXLE.

This occurs usually close to the wheel and outside of the driving box. If a broken main driving axle, *all rods* on the disabled side and *all* side-rods on the good side must come down. With any other driving axle only such rods should come down as would give trouble to the rest of the rods. See chapters on broken crank pins and rods. To block up the axle on the broken side remove the cellar and put a wooden block between the axle and the binder brace. If an hydraulic or screw jack is handy raise the axle and driving box, if it has an overhung spring and block under spring saddle above the frame to take the weight off of driving box. Use sponging on the sides of blocking under axle or better still your hot main pin grease.

29. BROKEN FRAME.

For a broken frame ahead of main driver disconnect the valve stem on disabled side, cover ports and leave up main rod. Bring your engine in *light* with the good side. If the break is behind the main driver take down side-rods on rear section only if a consolidation. With a mogul type and the knuckle pin on forward section of side-rod, take down all side rods.

30. KEY OUT OF FRAME SPLICE OR CYLINDER SADDLE.

Unless the key has been lost, try and put it back with the use of liners to secure it snugly. The cylinder saddle key is a taper affair, while the frame key is a square one, and with the latter a rod key driven in and watched occasionally will bring in the engine without shearing frame bolts. With nothing to replace saddle key, disconnect valve stem and cover port on that side.

31. BROKEN DRIVING BRASS.

Run the wheel upon a frog or wedge and block up between the frame and spring saddle to take weight as much as possible off of box.

With an engine having underhung springs there is no saddle to block under and in a case of this kind place a jack under equalizers nearest to broken brass, then block the other end between frame and equalizer and remove the spring under broken brass if possible.

32. BROKEN EQUALIZER BETWEEN FORWARD DRIVER AND ENGINE TRUCK ON MOGUL OR CONSOLIDATION.

If the break is at the forward end get a jack and raise that end as high as possible, lay a rail across the frame and secure the equalizer with the chain to the rail. If the rear end, or the hanger connecting the equalizer to the cross-equalizer is broken, raise the equalizer the same as in the other case and secure it with a chain to a rail placed on the frame behind the cylinders. Bring the cross-equalizer down from the boiler and block between the boiler and cross-equalizer also.

33. BROKEN ENGINE TRUCK WHEEL OR AXLE.

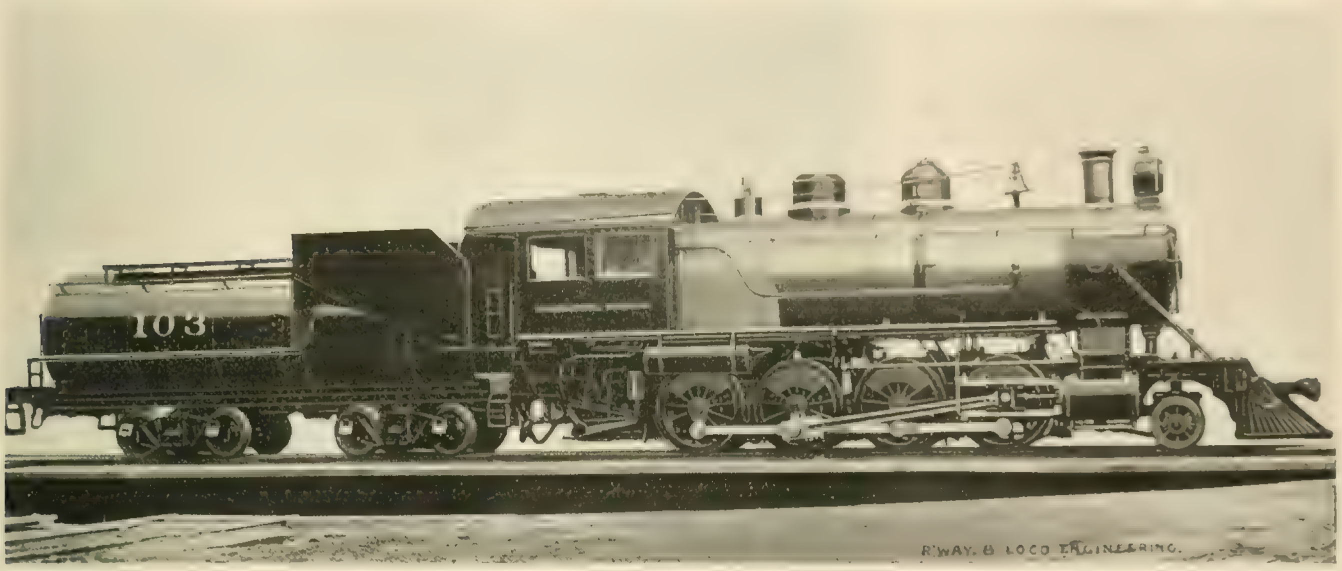
This is an aggravated case and requires considerable judgment. If it is a broken tire or a broken wheel, jack up the front end of the engine to take the weight off the truck. Take out the cellar and block with a V-shaped block of wood between the axle and pedestal brace. Jack up the truck frame high enough to allow broken wheel to clear the rail and secure the truck to the engine frame with a chain.

Baldwin 2-8-0 for the Internacional Mexicano.

The Mexican International has recently received some simple consolidation engines from the Baldwin Locomotive Works, at Philadelphia. The cylinders are 22x28 ins., the valves are balanced slide, and the diameter of the driving wheels is 57 ins.

The boiler is a straight top one and is 74 ins. at the smoke box end. The pressure carried is 200 lbs. The tubes are 365 in number, and are 15 ft. 1 in. long. The heating surface is made up as follows: fire-box 163 sq. ft., tubes 2,864.5 sq. ft., fire-brick tubes 25.3 sq. ft., making a total of 3,052.8 sq. ft. The grate area is 54.3 sq. ft.

The weight on the drivers is 169,500 lbs., the weight of the engine is 185,750 lbs., that of the engine and tender is about 336,000 lbs. The tender is of the Vanderbilt type and the cylindrical tank holds 8,000 gallons. The calculated tractive effort of this machine is about 40,400 lbs., and the ratio of tractive effort to adhesive weight is as 1 is to 4.19.



BALDWIN 2-8-0 FOR THE INTERNACIONAL MEXICANO

A very good example of the laudable desire for increased shop output was shown the other day in one of our important locomotive building establishments. Steel tires for engine truck wheels, passenger tender wheels and carrying wheels for locomotives are when required bored out on a boring mill having two spindles. In the case which came under our observation a tire was being bored out, and one tool on one side of the mill was cutting the lower half of the tire and on the other, the second tool was boring out the upper portion, so that the tire in question would only occupy half the usual time required for this operation, after which it would give place to another tire.

The numerous readers of RAILWAY AND LOCOMOTIVE ENGINEERING who are acquainted with Mr. R. H. Soule will rejoice to learn that he has recovered sufficiently from his protracted illness to resume business. Mr. Soule is carrying on the business of mechanical engineer in offices at 20 West 34th street, New York, where he makes a specialty of consulting and designing. To our readers who are likely to need the assistance of a well-trained mechanical engineer, we would say make a note of Mr. Soule's address.

Very few people imagine the amount of water required to fill a 6,000 gallon capacity tank of one of the new Wabash locomotives. If a man were to attempt to fill one by emptying a five-gallon bucket full every minute without stopping for rest, meals or anything else whatever, it would take him exactly twenty-four hours. If a man were working by the day, taking his time to it, and stopping for meals, rest, etc., and had a supply of water handy, so convenient that he could empty a bucket full every minute, if necessary, he would find that four days in which to perform the work would be a hard job.—*Logansport (Ind.) Reporter.*

Be diligent, work for a steady independence, and be happy.—*Dombey and Son.*

Phoebe on the Stage.

A very interesting moving picture was recently shown at one of Mr. F. F. Proctor's four New York theaters. The projecting apparatus used in these popular playhouses is Paley's Kalatechnoscope. The picture was none other than the railway marriage of Miss Phoebe Snow, of Buffalo, on the road of anthracite, otherwise the D., L. & W., more commonly known as the Lackawanna. Phoebe, who is always dressed in pure white and wears a beautiful white pompadour hat, travels through the famous Delaware Water Gap in the Blue Ridge Mountains, while an engaging young man points out to her the beauties of the scenery We call this young man "engaging," because he subsequently marries Phoebe over the rear coupler of the last car. The presence of a coupler at the ceremony, you will admit, is highly appropriate.

The scenes are all well taken and are full of interest, the one where the lovers chat on the back platform of the observation car while flying along is particularly realistic, and reflects credit on the ingenuity of the Edison Manufacturing Company, who supplied the films. Just before the train stops the porter of the Pullman appears, whisk-broom in hand, prepared to do the customary "brushing" for a consideration, but is waved away, as there is no dust to brush off. When the train stops, pretty Phoebe alights, and her white gown and graceful figure easily make her the cynosure of all eyes.

The good natured humor of the whole thing is heightened by two tramps who have stolen a ride on the trucks, suddenly coming out from under the cars attired in full evening dress and crush hats, which latter were probably useful in the confined space under the car. These tramps indignantly refuse the services of a bootblack, who has run up to dust them off. There being no dust on the Lackawanna, the "brushing" business has completely fallen down.

The films for these moving pictures are ribbons of celluloid, and contain a series of separate instantaneous photographs taken at the rate of from 20 to 40 per second, according to the rapidity of motion of the object photographed. The pictures are three-quarters of an inch high by one inch wide. The film for this particular picture is 275 feet long, and Miss Phoebe may have the satisfaction of knowing that in order to entertain the audience at Proctor's for a few minutes, she has been photographed 4,400 times.

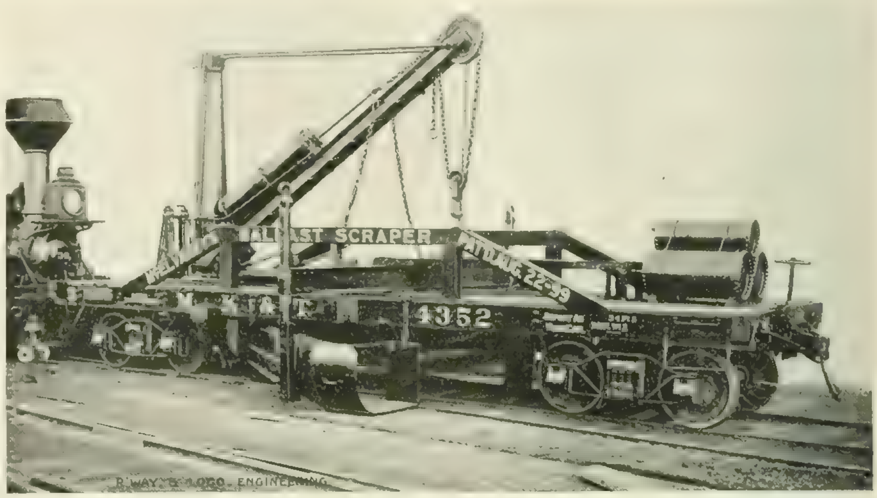
McElvaney's Ballast Spreading Scraper

The annexed engravings illustrate the appearance and the work done by a very successful ballast scraper invented and patented by Mr. C. T. McElvaney, master mechanic of the Missouri, Kansas & Texas Railway, at Denison, Tex.

The object of the invention is to provide a scraper for putting ballast between the rails that has been unloaded from the side of flat or side dump cars. With this appliance no special designed ballast car is required. This is one of the many reasons that should recommend its use, as many roads do not care to invest in special ballast cars to stand idle when not in service on work train, and even on larger systems, flat cars can be used to good advantage and many times in connection with other especially designed ballast cars, providing there was some means whereby the material could be placed where wanted without having to shovel it in by hand.

By referring to the engravings our readers will see that an ordinary flat car has been fitted up with scrapers on each side, in such a manner that they can be opened or closed, raised or lowered, as occasion may demand. When closed, they are drawn under the car body and six inches above the rail; when spread out they extend four feet beyond the body of the car and can be adjusted to any height from 6 inches above the rail to 10 inches below the botton of the ties. Two men can either open or close the scrapers in five minutes.

A crane is used to raise or lower the scrapers. In order to open or close them, an air cylinder is provided which is placed length ways of the car and the piston connection to a hinge joint in the center of the eye beam that extends crosswise of the car, and supports the open ends of the scrapers. As the piston is pushed out of the cylinder it acts on the hinge of the eye beam, forming a toggle joint drawing the scraper underneath the car. The discharge ends of the scraper are hinged in such a manner as to give a clear opening four feet wide.



McELVANEY'S BALLAST SPREADING SCRAPER.

BEFORE SPREADING

AFTER SPREADING.

If wishes were horses beggars would ride, is an old saying. Some men spend their lives supinely wishing that something would turn up for their benefit. Then they say it was good luck which helped their neighbor, who had will and energy to make everything turn up to his advantage.

Of Personal Interest.

Mr. H. R. Stevens has been appointed master mechanic on the Atlantic Coast Line at Sanford, Fla.

Mr. A. C. Hone has resigned the position of master mechanic on the Louisville & Nashville, at Louisville, Ky.

Mr. C. V. Mary has been appointed foreman of the Calder, Kan., shops of the Chicago, Rock Island & Pacific.

Mr. George Hoeffle has been appointed foreman blacksmith of the Knoxville, Tenn., shops of the Southern Railway.

Mr. J. R. Crowley has been appointed foreman of the air brake department of the Illinois Central at Waterloo, Ia.

Mr. H. S. Jones has been appointed master mechanic on the Durham & Charlotte Railroad, with headquarters at Gulf, N. C.

Mr. W. J. Camp has been appointed electrical engineer of the Canadian Pacific Railway, with headquarters at Montreal, Que.

Mr. H. P. Timmerman has resigned his position as general superintendent of the Ontario division of the Canadian Pacific Railway.

Mr. D. A. Hatheway has been appointed master mechanic on the Chicago, Rock Island & Pacific, with office at Fairbury, Neb.

Mr. W. A. Fort has been promoted to the position of resident engineer on the Southern Railway, vice Mr. O. D. Killebrew, promoted.

Mr. W. E. Anderson has resigned as master mechanic of the Colerado division at Goodland, Kan., on the Chicago, Rock Island & Pacific.

Mr. O. D. Killebrew has been promoted to the position of assistant superintendent on the Southern Railway, with office at Columbia, S. C.

Mr. F. Coe has been appointed roundhouse foreman at Riverside, Ohio, on the Big Four, vice Mr. J. Keegan, who retired on account of ill health.

Mr. H. A. Sadler has been appointed general car foreman on the Atchison, Topeka & Santa Fe, at Needles, Cal., vice Mr. M. Whitefleet, resigned.

Mr J. J. Shaw has been appointed master mechanic of the Denver, Enid & Gulf Railroad, with office at Enid, O. T., vice Mr. W. H. Whitaker, resigned.

Mr. L. Huber has been appointed general foreman of the Springfield, Ohio, shops, of the Detroit Southern Railroad, vice Mr. F. Distelrath, resigned.

Mr. J. J. Flynn has been appointed master mechanic of the Louisville & Atlantic Railroad, with headquarters at Richmond, Ky., vice Mr. L. Wellisch, resigned.

Mr. John R. McIntosh has been appointed boiler inspector on the Grand Trunk Railway system, with headquarters at Montreal, vice Mr. J. Black, resigned.

Mr. W. L. Williamson has been promoted to the position of superintendent of terminals of the Southern Railway, at Jacksonville, Fla., vice Mr. A. Tripp, resigned.

Mr. A. J. Fries has been appointed division master mechanic on the Boston & Albany Railroad, with headquarters at Allston, Mass., succeeding Mr. William H. Taft.

Mr. George Oliver has resigned as master mechanic on the M. K. & T., to accept the position of master mechanic of the Mexican Central, with office at Mexico City, Mex.

Mr. E. P. Reynolds, Jr., has been appointed consulting engineer of the Grand Trunk system. He has charge of the location and construction of the Grand Trunk Pacific.

Mr. N. E. Brooks has been appointed division engineer, Western Division, Canadian Pacific Railway, with headquarters at Calgary, Alta., vice Mr. A. S. Dawson, resigned.

Mr. W. G. Wallace has been appointed master mechanic of the Duluth, Missabe & Northern Railway, with full charge of the locomotive department, with office at Proctor, Minn.

Mr. C. E. Cartwright has been appointed acting division engineer, Pacific Division, Canadian Pacific Railway, with headquarters at Vancouver, B. C., vice Mr. F. F. Busteed, transferred.

Mr. C. P. King has been promoted to the position of trainmaster, Charlotte to Jacksonville including Columbia Terminals, on the Southern Railway, vice Mr. W. L. Williamson, promoted.

Mr. A. L. Robinson has been appointed master mechanic of the St. Louis-Louisville lines of the Southern Railway, with headquarters at Princeton, Ind., vice Mr. D. Brown, resigned.

Mr. L. R. Clausen has been appointed signal engineer on the Chicago, Milwaukee & St. Paul Railway, with office at Milwaukee, Wis. vice Mr W. H. Elliot resigned.

Mr. P. H. McGuire has been appointed master mechanic on the Great Northern. He will have charge of the Superior and Mesabi divisions, with office at Superior, Wis., vice Mr. G. A. Bruce, promoted.

Mr. G. S. Pflaster, formerly supervisor of signals on the Chicago & Eastern Illinois, has been appointed signal inspector on the Nashville, Chattanooga & St. Louis, with office at Nashville, Tenn.

Mr. T. M. Ramsdell, formerly chief car inspector of the Atchison, Topeka & Santa Fe at Topeka, Kan., has been appointed master car builder on the Chesapeake & Ohio, with headquarters at Huntington, W. Va.

Mr. James R. Nelson, who has heretofore been chief clerk to Sir Thomas Shaughnessy, president of the Canadian Pacific, has been appointed division superintendent on that road, with headquarters at North Bay, Ont.

Mr. W. D. Watkins, traveling engineer on the Illinois Central at Jackson, Tenn., has been promoted to the position of master mechanic on the same road, with office at Water Valley, Miss., vice Mr. J. F. Price, resigned.

Mr. R. O. Cumbach, who has been for several years general inspector of locomotives of the Central Railroad of New Jersey, has resigned to take the position of superintendent of the Pedrick & Ayer Company's plant at Plainfield, N. J.

Mr. J. W. Doyle, formerly train master at Clinton, Ia., on the Chicago & Northwestern, was appointed assistant superintendent at Boone, to succeed Mr. G. W. Dailey, promoted to acting superintendent of telegraphs at Chicago.

Mr. F. H. Hammill, train master at Boone, has been transferred to Clinton, Ia., on the Chicago & Northwestern, to succeed Mr. Doyle, and Mr. C. F. Milett, agent at Des Moines, has been promoted to the position of train master of the West Iowa Division at Boone.

Mr. Thomas Roope has been appointed to the position of assistant superintendent of motive power on the Chicago, Rock Island & Pacific, with headquarters at Topeka, Kan. This office has just been created. He was formerly general master mechanic on the Great Northern.

Mr A. McCormick has resigned from the position of master mechanic at Fairbury, Neb., on the Chicago, Rock Island & Pacific, and has accepted the position of master mechanic on the Colorado Springs & Cripple Creek District

Railway, with office at Colorado Spprings, Col.

Mr. Irving H. Reynolds will shortly retire from the Allis-Chalmers Company, and the duties of chief engineer will be assumed by the engineers in charge of the various departments, these engineers availing themselves of the advice of Mr. Edwin Reynolds, consulting engineer of the company.

Mr. C. A. Goodnow has been appointed general manager of the Chicago & Alton Railway Company, in charge of the operation and maintenance of the property. Mr. J. H. Barrett, general superintendent, having resigned, the duties of his office will, until further notice, be performed by the general manager.

Mr. David H. Beecher, president of the Union National Bank, of Grand Forks, N. D., is also president of a new railroad soon to be built from Mankato, Minn., to St. Cloud, Minn. The road will be called the Minnesota Central. Mr. Beecher is also president of the Lawson Boat and Car Company, of New York.

Mr. Charles Murphy has been appointed superintendent of District No. 2, Canadian Pacific Railway, with office at Toronto, vice Mr. James Manson, transferred. District No. 2 has been extended over the Toronto and Hamilton Terminals, of which Mr. F. G. Martyn has been appointed assistant superintendent, Toronto, vice Mr. D. R. Bell, transferred.

Mr. Joseph M. Whalen, who formerly held the position of general foreman of the St. Louis Division shops on the Cleveland, Cincinnati, Chicago & St. Louis, at Mattoon, Ill., has been promoted to the position of general foreman of the locomotive and car department at Indianapolis, Ind. He has been succeeded at the Mattoon shops by his brother, Mr. James F. Whalen.

Mr. George D. Brooke, superintendent of machinery and equipment on the Iowa Central, has resigned his position. On his leaving the service of the company Mr. Brooke was presented with a chest of solid silverware, consisting of 129 pieces. Mr. Joseph Mohr, of the machine shop staff, made the presentation. The committee representing the entire system was composed of Messrs. J. M. Speer, of the locomotive department; J. C. Crellin, machinist, and George Patton, of the car department. A reception was held at the close of the presentation. The cordial feeling manifested was evidence of Mr. Brooke's popularity all over the road.

Mr. Robert P. Allison, heretofore foreman of the wheel and cylinder shop of the Richmond (Va.) works of the American Locomotive Company, has accepted a position with the Locomotive and Machine Company, Ltd., of Montreal, Canada. His retirement from the works was the occasion of a presentation to him, by the shopmen of a very handsome Knight Templar watch charm, and also an equally beautiful Shriner's jewel. Mr. Jonathan Bryan, son of the former president of the works, made the presentation, and most fittingly expressed the hearty good will and high estteem felt for Mr. Allison by all ranks in the Richmond works. He goes to the Northern Zone followed by the best wishes of his many friends and associates in the Sunny South.

The Author of the Ready Reference.

Mr. S. A. Alexander is one of the old stock of railroad men who has succeeded in imparting to the rulers of the cab a

S. A. ALEXANDER

large amount of information which he acquired by observation and an experience of fifty-two years in railroad service. He was born in Philadelphia on the 31st day of August, 1829. After a few years' attendance at public schools in that city, at the age of thirteen he left school and friends unexpectedly, and went to sea as a cabin boy on a merchant vessel trading between New York and Vera Cruz, Mexico. After leaving that service he entered the United States Navy as an apprentice, cruising in the Gulf of Mexico, the west coast of Africa and the Mediterranean. Returning to the United States in 1848, at the solicition of his friends, he left the ocean and entered the employ of of the Philadelphia & Reading Railroad Co. at Palo Alto. As he had a good supply of sailor rigging and little cash, he continued to wear his sailor toggs until they were beyond repair, this circumstance causing him to be known by all the Reading's railroaders as Wootten's sailor. After serving his time with the Reading Co. at Palo Alto, Reading and at Richmond (Reading's Philadelphia terminal), he went to Altoona in the employ of the Pennsylvania R. R. Co., in the month of May, 1855, and remained in that employ until on January 1, 1900, he retired on account of having reached his seventy-first year.

Mr. Alexander claims that he wrote his book for the express purpose of being of benefit to the engineers and firemen in the employ of his own company, not expecting any pecuniary benefit, only for the advertisements contained in the last pages of the first issue of the work. Newly-employed engineers and old firemen and one on one division of the P. R. R. were sent to him for examination as to fitness for the positions. He found some old runners whom he knew to be capable men, but had never given a thought of what should be done in some cases of disablement. His sympathies went out to these men, so he had a few of such instructions put in print and gave them away; but he had so many applicants for the pamphlet that he had a thousand printed, and it was not long before he needed five thousand more, and these were still behind the demand. Although the work had not been advertised until after the first five hundred had been issued, orders came faster than they could be supplied. Some of the old runners were opposed to the work because, as they said, it was giving away all the tricks of the trade. Such remarks only reminded him of his experience while serving his time with the Reading Co. Machinists and other mechanics were chary of imparting information respecting their occupations, and many times he had been snubbed by the remark, "Go and find out as I did."

Mr. Alexander says that he was always nosey, having a very limited education and an inquiring mind, so he put himself down to hard study to know everything about the business in which he was engaged. He was the only boy out of about fifty on his ship while he was in the navy who attempted to acquire a knowledge of navigation; and now whatever knowledge he has he is always glad to impart to those who wish to have it. He has been a busy man, for, while working at his calling, he succeeded in bringing up a family of seven children, four of whom are boys, three of these are first-class locomotive runners and his baby boy is an officer in the United States Navy; all except the baby are married and have families, and all are doing well.

He says that "The Ready Reference" has found large sales in Canada, Mexico, Australia, New Zealand and Great Britain, as well as in Boston, from which point all knowledge is suppose to originate.

Artificial Niagara at St. Louis.

An immense artificial cascade has been determined upon by the authorities of the Louisiana Purchase Exposition as the centerpiece of the semi-circular lay-out of the principal buildings. The cascade itself will be divided into three parts; a large middle cascade with a smaller one at each side, the water flowing directly into the head of the Grand Basin. In all, about 90,000 gallons of water per minute will be supplied at a head of 159 feet, forming the greatest arificial water effect ever attempted. The water will be taken from the Grand Basin itself, and will be raised to the top of the fall by pumps placed under Festival Hall. The pumping machinery will consist of three 36-inch single-stage, turbine centrifugal pumps purchased from Henry R. Worthington, of New York City, each driven by a 2,000 horse-power Westinghouse alternating current motor. The total horse-power utilized will thus be 6,000, making this the largest electric pumping station in the world. The pumps and other pieces of machinery for this plant are now being installed at St. Louis.

Club agents would earn blessings from the young ladies of our mailing department by sending in their list early in the month.

A Long-Felt Want.

Casey—Oi see there's bin another railroad wreck due to an open switch.

Cassidy—Ay, 'tis a pity some wan don't invint a switch thot'll stay shut whin it's open.—*Philadelphia Press.*

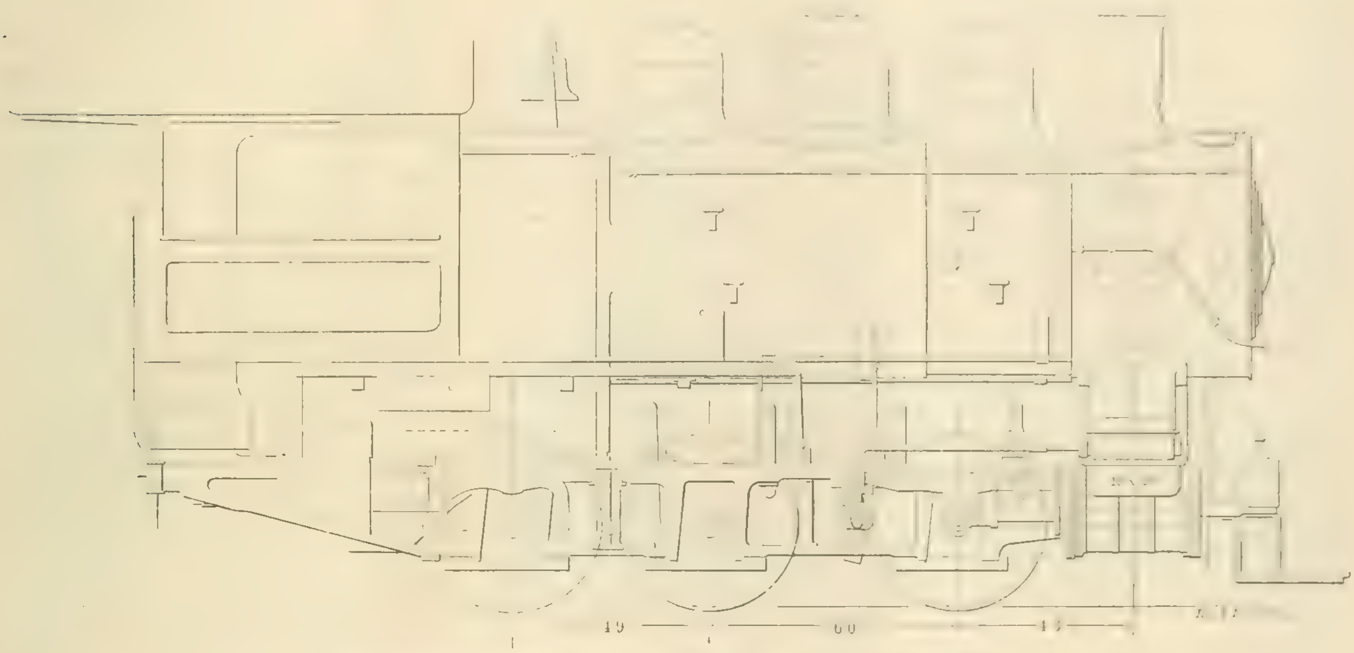
Six-Wheel Switcher for the Great Northern.

The Rogers Locomotive Works, of Paterson, N. J., have recently supplied the Great Northern Railway Line, of which Mr. G. H. Emerson is superintendent of motive power, with ten switch engines of the six-wheel type. The cylinders are 19x26 ins. and the drivers are 49 ins. in diameter. The entire weight of the engine, of course, rests upon the driving wheels, and this amounts to 138,000 lbs., making the axle load 46,000 lbs. The journals are 9x12 ins. The pistons drive on the middle wheels. The crosshead is one of the Laird type and the main valves are the regular D-slide.

The boiler is a straight top one, with Belpaire fire box. It is 67½ ins. at the front end. The fire box, with grate area of 27.2 sq. ft., has also a heating surface of 164 sq. ft., and that of the tubes being 1,708, brings the total heating surface up to 1,872 sq. ft. The working pressure is 200 lbs. per sq. in.

The tender has a water capacity of 400 gallons, and the tank is carried upon 10-in. steel channels in the usual way. Diamond arch bar trucks are used.

The calculated tractive force is about 32,500 lbs., and the ratio of tractive power to adhesive weight is as 1 is to 4.24. The total wheel base is 10 ft. 9 ins.



ROGERS SIX-WHEEL SWITCHER FOR THE GREAT NORTHERN.

Fatal Collision in a Scotch Station.

The deliberate manner in which the government officials having supervision over British railways do their work, is well illustrated by a report recently published from Col. York, inspector for the Board of Trade, on an accident which happened in Glasgow as long ago as July 27. A passenger train belonging to the North British Railway, entering St. Enoch Station, was not properly under control of the engine driver, and it struck the buffer stop with such violence that two carriages were telescoped with the result that seventeen passengers were killed and 64 were injured.

The principal blame is put upon the engine driver, for not having the train under proper control; but the railway company is severely censured for using antiquated brakes. A curious thing about Col. York's report is that he considered it necessary to discuss recommendations made by various persons, that empty carriages or vans should be placed between the engine and passenger coaches to receive the destructive shocks experienced when a collision happens. This was entirely in line with a practice introduced by the South Carolina Railroad about 1833, of putting a car loaded with bales of cotton between the locomotive and the passenger cars to protect the people from injury when the boiler exploded. Another recommendation which will appear strange to American railway men is, that trainmen must be ready to apply hand brakes when entering terminal stations. The real cause of the collision was the use of brakes that were deficient in stopping power. About them Col. York says:

"I would make the suggestion that the time has come for a reconsideration of the brake question in this country. I do not now refer to the dual system which, unfortunately, exists, some companies having the vacuum and some the Westinghouse, though this is all-important, and will have to be faced if freight

trains are to be fitted with continuous brakes. But I refer to the fact that the brakes employed on the passenger rolling stock in the United Kingdom, whether they belong to the vacuum class or the Westinghouse class, are not of the most modern description. Since automatic continuous brakes were first adopted in this country, improvements have been made in them whereby their rapidity of action has been largely increased, and the distance or time within which a train can be stopped has been proportionately reduced. Both the Vacuum Brake Company and the Westinghouse Brake Company have for some years past been able to supply quick-acting brakes, the advantage of which in times of emergency cannot be gainsaid. These improvements, though adopted, seem to have been ignored in the United Kingdom, where, so far as I know, only one railway company has done anything, even experimentally, towards fitting its passenger stock with a quick-acting pattern of brake. The speed and weight of trains are ever on the increase, and the rapidity with which brakes can be brought into operation becomes daily of more importance. It is, therefore, surprising to find that the modern improvements in brakes have not been adopted in the United Kingdom, and that English rolling stock is still being fitted with the same patterns of brakes as were introduced twenty-five years ago.

The Nature of a Patent Right.

BY PAUL SYNNESTVEDT.*

It is the writer's observation that of all the common mistakes chargeable to those not posted in patent matters, the mistake which is most frequently encountered by the patent practitioner is the supposition that seems to be held, on the part of many, that the grant of a patent to an inventor conveys in some manner the right to the use of his invention. The fact of the matter is that no right of this kind is conveyed by U. S. Letters Patent, but only the right to *exclude others* from using the invention which forms the subject matter of the patent; in other words, the right of *exclusion* for a limited time, whereby a monopoly may be created which may bring to the patentee some return for the labor involved in the development of his invention.

The patent system, as we know it now in this country, is altogether on these lines: The Government, in the grant of a patent, undertakes to protect the patentee for a period of 17 years in the right to exclude every one else from making, using and selling his invention, save only on consent of the patentee. Before the grant of any patent, every inventor has the right to make, use and sell his invention, assuming that such manufacture, use or sale does not infringe any other pre-existing right, but until a patent is granted every one else has a like right, and hence what the patentee actually gets is the right to take away from every one else the liberty of following in the patentee's footsteps with respect to such manufacture, use or sale of the invention.

It is a peculiar incident to this grant, that unless the public at large is given the benefit of the invention by commercial introduction of the same, no benefit, financially, accrues to the owner of the patent. This is obvious from the fact that the only recompense in a financial way which a patent owner gets comes, ultimately, either from royalties or from profits arising out of the manufacture, use or sale of the patented improvement, and, as intimated, unless some commercial operation is carried out, of course, no royalties are collectible, nor are any profits made.

In considering the nature of a patent right, it is next to be noted that the grant of a patent is not made, as is often assumed to be the case, for the sake of the *inventor*, but from the standpoint of public policy, for the sake of the *public good*, in order "to encourage the progress of science and the useful arts," as it is stated in that clause of the Federal Constitution which forms the basis for all our patent statutes. And the wisdom of the framers of our Constitution, in making a provision of this kind, has been fully proven by the experience of over 100 years, during which some patent system has been in force in this country. Whenever inventors have been encouraged in this manner, industry and progress have prospered, and wherever they have not, as for example in certain districts through an unfavorable attitude assumed by some of our courts, industry and progress have been correspondingly discouraged.

That all patentees who hold *valid* patents have benefited the community is obvious, from the fact that in order to sustain the validity of any patent it must, among other tests, stand the test of novelty and utility; that is, it must be established that the invention is *new*, and adds something in the nature of improvement of a *useful* character to the arts as the state of the same existed before the creation of the invention. If a patent grant took from the public the right in any thing of a determinative or definite character, or a right in any property formerly possessed by the public, it would be inconsistent with the spirit of our age and obnoxious to people of all classes, as was, in fact, the case with some of the older statutes and special privileges which existed for several centuries past in England at different times.

In the words of Bentham, in his Rationale of Reward, a patent "is an instance of a reward peculiarly adapted to the nature of the service, and adapts itself with the utmost nicety to those rules of proportion to which it is most difficult for reward, artificially instituted by the legislature, to confer. If confined, as it ought to be, to the precise point in which the originality of the invention consists, it is conferred with the least possible waste of expense. It causes a service to be rendered, which without it, a man would not have a motive for rendering; and that only by forbidding others from doing that which, were it not for that service, it would not have been possible for them to have done. Even with regard to such inventions, for such there will be, where others besides him who possesses the reward have scent of the invention, it is still of use by stimulating all parties and setting them to strive which shall first bring the discovery to bear. With all this it unites every property that can be wished for in a reward. It is variable, equable, commensurable, characteristic, exemplary, frugal, promotive of perseverance, subservient to compensation, popular and reasonable."

That the patent system is distinguished by having an origin of reasonable antiquity is evident from the fact that we find that in the reign of Edward III, on representation to him of the feasibility of making a "philosopher's stone," that monarch issued a commission of two friars and two aldermen to inquire into the matter, and, on their reporting in its favor, granted to them and their assigns the *sole* privilege of making the "philosopher's stone."

Nearly all of the earliest forms of such grants in England, dating several centuries back, were of similar characteristics to those of our present patent grant, but the special privileges of those early days were by degrees perverted from their primary purpose, and, under the pretense of a better government of trade, the prerogative of the Crown was employed in return for pecuniary considerations in sanctioning certain individuals and corporations in the practice of various oppressive monopolies. The evil of this grew until in the reign of Elizabeth, large numbers of the necessaries of life were controlled by such monopolistic patentees.

Thus, at one time, there were included in such oppressive special grants the exclusive rights of trade in salt, iron, powder, vinegar, paper, starch, tin, sulphur and a multitude of others.

When a list of them was read in the House of Commons a great disturbance was raised, one member crying: "Is not bread in the number? If affairs go on at this rate we shall have bread reduced to a monopoly before next Parliament."

The monopolists were so exorbitant in their demands that they raised the price of salt from 16 pence a bushel to 14 or 15 shillings. Such high profits naturally began to attract intruders upon their commerce, so that in order to secure themselves against encroachment the patentees

*Abstracts of paper read at Pittsburgh Railway Club.

were armed with high and arbitrary powers by the councils, by which they were able to oppress the people at pleasure, and to exact money from such as they thought proper to accuse of interfering with their patent.

Thus the patentees of saltpetre were granted the power of entering every house "and of committing what havoc they pleased, in stables, cellars, or wheresoever they suspected saltpetre might be gathered, and they commonly extorted money from those who desired to free themselves from this damage or trouble; and while all domestic intercourse was thus restrained, lest any scope should remain for industry, almost every species of foreign commerce was confined to exclusive companies, who bought and sold at any price they themselves thought proper to offer or exact."

"Even Elizabeth's House of Commons rang with angry complaints. On the 20th November, 1601, a great debate upon the subject took place, on an attempt by Lawrence Hyde to introduce 'A Bill for the Explanation of the Common Law in Certain Cases of Letters Patent.' After much discussion as to whether the proceedings should be by bill or by petition to Her Majesty, but before anything was concluded upon the Queen sent a message to the House importing that the monopolies should be revoked."

In excusing the objectionable grants, the Queen, in a message to the Commons, said: "Since I was Queen, yet never did I put my pen to any grant but upon pretense and sembiance made unto me that it was both good and beneficial to the subjects in general, though a private profit to some of my ancient servants who have deserved well, but the contrary being found by experience, I am exceedingly beholden to such subjects as would move the same at first. That my grants should be grievous to my people, and oppressions to be privileged under color of our patents, our kingly dignity shall not suffer it; yea, when I heard it I could give no rest to my thoughts till I had reformed it."

While subsequently to the events just narrated special grants in restraint of common trade were gradually reduced in number to practically nothing, exclusive privileges in reward of invention have remained, and there is reason to believe that the practice of making grants of the sole use of inventions originated in England, and that the English system of rewarding inventors has since been copied more or less closely by almost every European power. Our own system is based upon it in many respects, although differing greatly in organization and detail, and the characteristics or nature of the grant remain to this day, after centuries of time, substantially the same—the securing to an inventor, for a limited time, the right to *exclude* others from practicing his invention save on license secured from him, wherefrom he secures his pecuniary reward.

Railway Matters in Australia.

From a letter received from a subscriber in Australia, we cull the following notes concerning railway matters in the Colony of Victoria:

Mr. Thomas Tait is Chief Commissioner of Railways now, being Chairman of the Commissioners. These number three, namely, Mr. Thomas Tait, Chairman; Mr. Fitzpatrick and Mr. Hudson. The two latter gentlemen have had good experience in Australasian railway management. It was thought that under the rule of these three gentlemen the Victorian Railways would soon begin to pay their way. But many people believe that they will never pay because of the great amount of political jobbery that is done in connection with the railways.

This interference was manifested recently. The Commissioners decided to close up a line which had been run at a loss ever since the construction of it. Immediately a great concourse of people affected by the closure, accompanied by numberless members of Parliament, interviewed the Commissioners with the result that the line was at once reopened. This example will suffice to show what enormous political influence the new Commissioners will have to contend against in their efforts to place the railway finances on a sound basis.

The reason the railways will not pay, is because during the land boom period railways were built anywhere and everywhere at the bidding of the local members of Parliament. Now, fully fifty per cent. of these lines will not pay, so anyone can see where the root of the evil lies. There are four ways of attempting to make the railways solvent, namely:

1. Closing all non-paying lines; 2. raising freights; 3. raising fares; 4. Reducing working expenses.

The general public have no doubt but that the last named was the best manner of curing the railway overdraft disease, if one might call it so. This meant an indirect reduction in wages and thus it led to the great railway strike of 1903, which resulted in the total defeat of the strikers.

DUNDAS LIGHT RAILWAY MONTEZUMA TRESTLE

Under-Loading of Cars.

The following circular sent to station agents by the manager of the Southern Pacific lines in Texas, might be judiciously sent to station agents of nearly all railroads:

"Ten years ago the average capacity of these companies' freight cars was 21 tons; to-day, the average capacity is 29 tons. Ten years ago the average loading was 13 tons; to-day, it is 19 tons. From which it will be seen that the loading has not kept pace with the increased capacity. The demand for cars is very great. If we can increase our loading 2 tons per car, it will have the practical effect of adding not less than 1,500 cars to our equipment. In order that we may be in a position to furnish cars to take care of all business offering, and at the same time utilize our equipment to the best possible advantage, it is necessary that the question of loading be given close attention, and from date of this circular to June 30, 1904, to 10 agents making the best showing in car loading, premiums based on one-third of one month's salary will be given.

Of the 10 premiums, one will be awarded to agents on the El Paso division, four on the Houston division, two on the Victoria division and three on the Texas and New Orleans and Galveston, Houston and Northern. By keeping careful track of the loading of cars and calling shippers' attention to their interest in the matter, it is confidently expected that great improvements can be made, and the hearty co-operation of all employees toward that end is earnestly desired."

Distilled Feed Water.

At a meeting of the Western Railway Club, where the purification of feed water was under discussion, some attention was given to distilling feed water as a means of removing impurities. That is an extreme method, but it is, no doubt, effectual, as it removes all impurities from water so treated. Distillation would be an ideal way of preparing feed water in districts where mineral salts abound in the water, but it is so expensive as to be prohibitive, unless where coal or other fuel is extraordinarily cheap. Mr. G. R. Henderson made the statement that with coal at one dollar a ton, water could be distilled for 13 cents per thousand gallons. That is an exceedingly low expense, and indicates that great improvements have been effected recently on distilling apparatus, yet it represents a heavy increase on the operating expenses of a locomotive, but the quality of feed water may be such that adding one or two cents extra for eliminating scale and all of its works may effect a decided saving. In regions where the feed water is so bad that flues have to be changed for every 10,000 miles of service, it is likely that distilling the water would pay for the expense of changing the flues would represent only a small part of the loss sustained. We believe that some of the methods of purifying water without going the length of distillation are good enough for all practical purposes, but there is no question about the purity of distilled water.

At the meeting where Mr. Henderson's paper was read the agent of a boiler compound concern tried to discredit the use of distilled water by saying that its use induced corrosion of the boiler sheets. That is a very feeble objection, based on a distortion of facts. In marine service while the jet condenser was in use and pure sea water was boiled in the boilers, a constant source of trouble was the sulphate of lime present in the water forming thick scale over the evaporating surfaces. In the surface condenser the exhaust steam is passed through tubes where it is condensed by the circulation of cold water and the condensed water is pumped back into the boilers. This cycle of operations goes on constantly and where there is very little leakage about boilers or engines very little replenishing of water is necessary during a long voyage. Of course, feed water produced in this manner is entirely free from mineral impurities although there is more or less annoyance due to the lubricants that have been used in the cylinders passing into the boiler.

When the surface condensers were first introduced it was discovered that corrosion of the boiler plates were much more common than it was when water containing lime salts was used. The worst cases were found to be where boilers and engine glands were particularly free from leakage, thereby obviating the use of sea water. The matter was thoroughly investigated by experts and it was discovered that water absolutely free from mineral

HAGAN'S PATENT 40-TON 2-FOOT GAUGE ENGINE AND TRAIN

impurities and mixed with oil had a corrosive effect upon iron and steel. An effectual remedy was found in using sufficient sea water to deposit a small quantity of lime inside the boilers. The lime accumulated in locomotive boilers from other sources may be depended upon to neutralize any corrosive tendencies of a few condensing stations.

That experience gave rise to the saying frequently heard among engineers that absolutely pure water has a corrosive effect upon boiler sheets. We doubt the correctness of this theory. In many regions of the world where igneous rocks cover the entire surface, all the water found is free from mineral impurities. When this water is used for boiler purposes it causes no corrosion; and locomotive boilers that have used it for decades will show sheets as free from pitting and grooving as they were the day they were put in. If the water was mixed with a little animal or vegetable oil, as those in marine boilers are, a compound might be formed which would cause corrosion of metal. Vegetable acids that are drawn from swamp water are said to have given a corrosive tendency to soft water; but it would be robbed of its venom by the lime deposits which are perniciously abundant in locomotive boilers.

To Club Raisers.

Many of our club raisers believe that it is the best way to wait until near the beginning of the year before sending in their list of subscribers. That is a mistake. The lists ought to be in not later than Dec. 15 to insure the names being put on our regular list, and by that means be promptly mailed.

Obituary.

Stephen D. Winner, probably the oldest locomotive engineer in active service in the United States, died recently at his home in Newark, N. J., aged eighty-one years. He began his career as an engineer on the old Germantown and Norristown Railroad in 1852. He had the first engine, the "David P. Baldwin," that was made at the Baldwin Locomotive Works. For more than forty years he was connected with the Central Railroad of New Jersey, and for the last twelve years had run a switching engine in the yards of that company in Newark.

An unfortunate accident, resulting in the death of D. W. Jackson, general foreman of the Elmira shops, of the Delaware, Lackawanna & Western, has deprived that road of a competent officer, and one whose loss is universally mourned by all who knew him. Mr. Jackson was injured by being struck by an engine on October 3, while superintending some work on a locomotive which was standing near the shop. He had only been in charge of the shop for about one year, but in that short time he endeared himself to all those with whom he came in official contact. As a loving tribute to his memory the Lackawanna employees sent a guard of honor with his remains to the home of his sorrow-stricken parents. A set of engrossed resolutions was also sent to his mourning friends.

L. S. Heald & Son, formerly of Barre, Mass., are now located at Worcester, under the name of the Heald Machine Co. They make a line of special machine tools, twist drill grinders, etc.

Mr. J. M. Martin has resigned his position as district sales agent at the Philadelphia office of the Nernst Lamp Company, and Mr. A. E. Baker has been appointed as his successor.

Recorded Experience.

In those wonderfully interesting series of chapters called "Extracts from Chordal's Letters," the writer tells, in one of them, about an experiment in friction conducted with a load of bricks and some buckshot on the shop floor. He says: "Let us suppose that you were the party who did the experimenting with the bearing under the pile of bricks; that you spent six months' time, five hundred dollars in money, and used up lots of good judgment and patience; that all this happened one hundred years ago, and that you wrote it all down in your little book." Our author goes on to say: "Let your name be Moran, and assume that in the course of years your little book gets printed and accepted as an authority on such subjects." Then he tells us of a man who had been working thirty years at the machinists' trade, and as owner of a shop, and he says this man at last "begins to wonder if, after all, this thing he has misnamed 'theory' is simply a knowledge of the successful experience of other men."

We think that puts the case very neatly; the "book learning" which some men deride is just the recorded experience of those who have gone before. It does not require that the experience be 100 years old; some practical person's experience just a month old might be invaluable to you if you could get it. The way experience is recorded nowadays is in book form. Nobody supposes, however, that a book by itself, no matter how good, would make a dry goods clerk into a skilful locomotive engineer, or into a first class fireman, just as soon as he had read it over. That is because the kind of experience recorded in the book is not that which touches the dry goods clerk in his daily work, but it would help the engineer or fireman or

practical railroad man, because it is right in their line and can be understood and appreciated by them. Look at the list of books which follows—the recorded experience of others, that is what they really are, and judge for yourself if the probabilities are not in favor of some one or two of them helping you?

The first on the list is, of course, RAILWAY AND LOCOMOTIVE ENGINEERING, a practical journal of railway motive power and rolling stock. It costs only $2.00 a year, and is well worth the money, and besides the paper is a welcome visitor in every household. Let your wife and children see it.

"Locomotive Engine Running and Management," by Angus Sinclair, is an old and universal favorite. A well-known general manager remarked in a meeting of railroad men lately, "I attribute much of my success in life to the inspiration of that book. It was my pocket companion for years." We sell it for $2.00.

"Practical Shop Talks." Colvin. This is a very helpful book, combining instruction with amusement. It is a particularly useful book to the young mechanic. It has a stimulating effect in inducing him to study his business. The price is 50 cents.

"Examination Questions for Promotion." Thompson. This book is used by many master mechanics and traveling engineers in the examination of firemen for promotion and of engineers likely to be hired. It contains in small compass a large amount of information about the locomotive. Convenient pocket size. We cordially recommend this book. The price is 75 cents.

"Compound Locomotives." Colvin. This book instructs a man so that he will understand the construction and operation of a compound locomotive as well as he now understands a simple engine. Tells all about running, breakdowns and repairs. Convenient pocket size, bound in leather, $1.00.

"Catechism of the Steam Plant." Hemenway. Contains information that will enable a man to take out a license to run a stationary engine. Tells about boilers, heating surface, horse power, condensors, feed water heaters, air pumps, engines, strength of boilers, testing boiler performances, etc., etc. This is only a partial list of its contents. It is in the question and answer style. 128 pages. Pocket size. 50 cents.

"Care and Management of Locomotive Boilers." Raps. This is a book that ought to be in the hands of every person who is in any way interested in keeping boilers in safe working order. Written by a foreman boilermaker. Also contains several chapters on oil-burning locomotives. Price, 50 cents.

"Locomotive Link Motion." Halsey. Any person who gives a little study to this book ceases to find link motion a puzzle. Explains about valves and valve motion in plain language, easily understood. Price, $1.00.

"Machine Shop Arithmetic." Colvin and Cheney. This is a book that no person engaged in mechanical occupations can afford to do without. Enables any workman to figure out all the shop and machine problems which are so puzzling for want of a little knowledge. We sell it for 50 cents.

"Firing Locomotives." Sinclair. Treats in an easy way the principles of combustion. While treating on the chemistry of heat and combustion it is easily understood by every intelligent fireman. The price is 50 cents.

"Air-Brake Catechism." Conger. Nothing better can be found for persons trying to learn all about air brakes. Tells the whole story. New edition containing added matter relating to the New York Air Brake. Cloth, $1.00.

"Skeevers' Object Lessons." Hill. A collection of the famous object lesson stories which appeared in this paper several years ago. They are interesting, laughable and best of all they are of practical value to-day. $1.00.

"Stories of the Railroad." Hill. Best railroad stories ever written. Those who have not read these stories have missed a great literary treat. $1.50.

"Standard Train Rules." This is the code of Train Rules prepared by the American Railway Association, for the operating of all trains on single or double track. Used by nearly all railroads. Study of this book would prevent many collisions. Price, 50 cents.

"Mechanical Engineers' Pocket Book." Kent. This book contains 1,100 pages 6x3¼ inches of closely-printed minion type, containing mechanical engineering matter. It ought to be in the bookcase of every engineer who takes an interest in engineering questions. We use it constantly as a reference for questions sent to us to be answered. Full of tables and illustrations. Morocco leather, $5.00.

"Locomotives, Simple, Compound and Electric." Reagan. An excellent book for people interested in any kind of locomotive. It will be found particularly useful to men handling or repairing compound locomotives. It is the real locomotive up to date. $2.50.

RAILWAY AND LOCOMOTIVE ENGINEERING. Bound volumes. $3.00.

What is it to be educated? It is to learn to apply the natural conceptions to each thing severally according to nature; and further, to discern that, of things that exist, some are in our own power and the rest are not in our own power. And things that are in our own power are the will and all the works of the will.

Misogyny and Mechanisms.

He was a misogynist and a mechanician, and very, very young.. Unlike his companions, he disliked going to children's parties, and was remonstrated with by his mother.

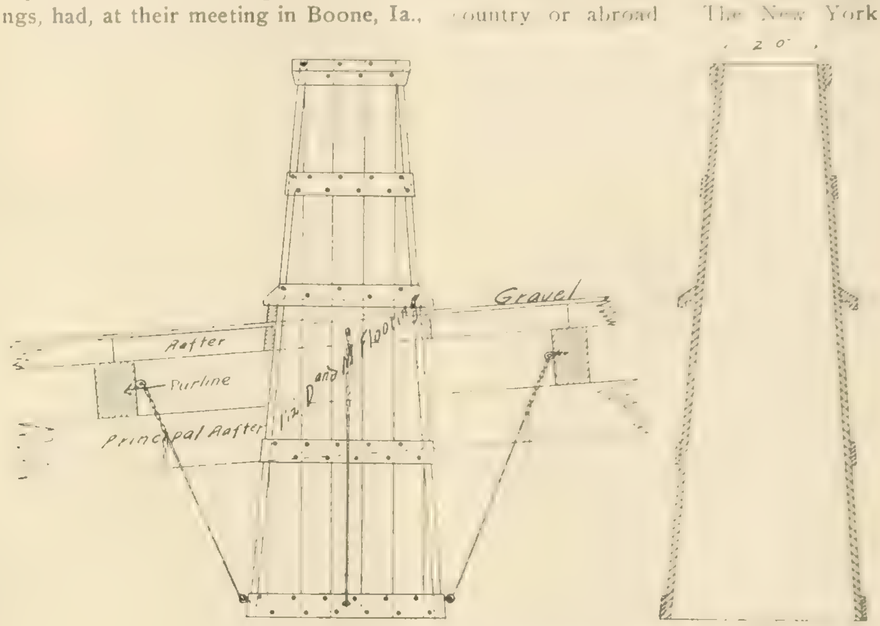
"Why don't you want to go to the party?" said the latter. "You surely don't prefer running your locomotives to dancing with little girls."

"Oh, but I do," answered the hope of the family. "Why?"

"Well," quoth the philosopher, "I understand girls."

Wooden Smoke Jack on the Chicago & Northwestern Railway.

The members of the convention of Superintendents of Bridges and Buildings, had, at their meeting in Boone, Ia., an opportunity to inspect a wooden smoke jack, designed by Mr. H. A. Walden, which was in use in the round house of the Chicago & Northwestern Railway.



ROUNDHOUSE SMOKE JACK MADE OF WOOD.

The jack, as will be seen from our illustration, is simply a taper conduit, measuring 4 ft. x 2 ft. at the base, and 2 ft. x 18 ins. at the top. This jack is the outcome of months of experimenting with wooden jacks. The lightness of the structure makes it easy to carry on an ordinary shop roof, and the roof repair account is correspondingly kept down. The inventor also claims cheapness as one of the advantages gained in the use of the jack. He says these jacks can be built and installed for $10.00 each, and their simplicity and durability make the maintenance charge small. It is painted inside and out with a fireproof paint.

The motive power department of the Chicago and Northwestern Railway are installing 10 of this style of jack in their Council Bluffs roundhouse and intend installing the Walden jack in their roundhouses at Boone, Belle Plaine, and other points on the system as soon as the jacks can be built. Mr. Walden, the designer of the jack, is assistant superintendent of bridges and buildings of the Iowa division of the Chicago and Northwestern Railway, and has applied for a patent on his invention.

The New York Central & Hudson River Railroad have placed an order with the General Electric Company for eight Turbo-generators, of a capacity of 7,500 horsepower each. The turbines are of the 4 stage vertical Curtis type. The generators are 25 cycle, 3 phase, generating current at a pressure of 11,000 volts. This is by far the largest order for steam turbines ever placed in this country or abroad. The New York Central Company has also placed with the General Electric Company, in cooperation with the Schenectady works of the American Locomotive Company, an order for 30 electric locomotives. These locomotives are of an entirely new design, will weigh 85 tons each, with an adhesive weight on the drivers of 67 tons. Each locomotive will have a capacity of 2,200 horsepower, and will be capable of hauling a train of 500 tons at a speed of 60 miles an hour. This is, without doubt, the largest order for electric locomotives ever placed in any country.

At a meeting of the Joint Executive Committee of the Master Mechanics' and Master Car Builders' Associations it was decided to hold the 1904 conventions at Saratoga Springs, N. Y. Atlantic City and Manhattan Beach were considered, but the former meeting place was again selected. The M. C. B. convention will begin June 22. That of the M. M. will follow.

Dotting Drawing Pen.

One of the newest and neatest things in the way of drawing instruments is a universal dotting pen for draughtsmen which has just been put on the market by E. G. Ruehle & Company, makers of mathematical instruments. The dotting pen enables one to draw a dotted line as fast as an ordinary straight one can be ruled by a draughtsman, and when drawn, all the dots or dashes are all of equal size and are equally spaced. A fine dotted line can be drawn, a line with short dashes or one with longer dashes, suitable for cross hatching or one with a long dash and two short ones can be drawn, as occasion demands. This latter can be used as a center line and looks well. The mechanism is simply a drawing pen which has a small toothed wheel beside it operating four other small wheels, each of which in revolving produces the desired line. The inking point is constantly raised and lowered from the paper as the pen is drawn steadily along. The width of the line can be varied as with the ordinary drawing pen. This should be a welcome instrument in the drawing office, and with students learning to draw, as it is a time saver and does most accurate work. The E. G. Ruehle Co. do business at 41 West 24th street, New York City.

The politicians of New York State submitted to the people a proposition to vote to spend $101,000,000 on the enlarging of the Erie Canal, which, as an active element in transportation, has been dead for twenty-five years. The people of New York City and of Buffalo, the two cities likely to receive any benefit from increasing the capacity of the long ditch, voted so numerously in favor of the scheme that it was carried. It will be a great thing for the politicians for the next decade or two, since the opportunities for stealings will be almost beyond parallel; but we are afraid that it will do nothing to reduce the cost of food products coming from the West to feed the people of the hungry seaboard. If half the sum were devoted to making roads, the people in every part of the State would receive substantial benefits.

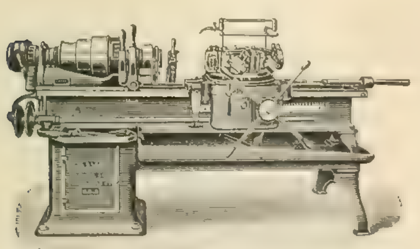
The National Battery Fan Company, St. Paul Building, New York, was incorporated for the purpose of manufacturing a portable battery fan for office or house use. The portable fan has a dry battery which unites the principles of the primary and secondary batteries in such a way as to retain the advantages of the primary battery while providing for periodic recharging. The battery is capable of running the fan for a week and the cost to the user is 50 cents per week. This fan should be popular, as having its own motive power, stored in its stand, it will not require one of the electric lamps in a room to be removed in order to connect wires, and in offices where electricity is not available this self-running fan will be a welcome novelty. It ought to be available in railroad service for cars not lighted by electricity, and thus do much to solve the vexed question of railway coach ventilation.

When contributors permit their handwriting to degenerate so that the characters look like the record on dynamotor car traction roll, they cannot justly blame us when the ideas they mean to convey get slightly twisted. We have lost a subscriber lately because he sent in some notes about a "powerful mogul" and the words were converted into "howling mongrel." Accidents will happen, as we say, but that is hardly so bad as the poet was treated who sent in a poem on Surcease of Sorrow and found the words converted into Smearcase to-morrow.

A new and very up-to-date pay car has lately been turned out of the Columbus shops of the P. C. C. & St. L. The entire car is bullet proof, floor, roof, sides and ends being covered with steel plates. The occupants of the car carry arms, and a heavy safe is used to hold the money. In addition to these precautions no large sums of money are ever carried; only enough is taken on board to pay employees from one large city to another. One end of the car is used as the paying office and the other is fitted with berths very similar to those of an ordinary Pullman car, and are for the use of the paymaster and his assistants.

President Smith is constitutionally opposed to giving passes and knows the entire literature of excuses for asking these favors. A stranger of classical appearance called at his office the other day and asked for a pass. "On what grounds?" demanded President Smith. "Merely because I don't want to pay my way," replied the stranger. "Come right in and sit down," said the president very cordially. "You can have the pass, for you are the only man I remember who was not a liar as well as a beggar."

The Lehigh Valley Railroad has just finished widening the gauge of the Montrose Branch from narrow to the standard gauge. This road was built some years ago as a narrow gauge road and runs from Tunkhannock to Montrose, Pa. a distance of twenty-eight miles. The Lehigh Valley Railroad Company has been in possession of the property for several years, and some months ago began the improvements referred to. From now on all trains operated on the Montrose Branch will be of standard gauge.



Electrically Operated Train on Fire After Collision.

When a railway collision happens on a steam line and people lose their lives through the cars taking fire, we always hear talk about the safety that would be insured by electric operating. An accident that happened to two electrically operated trains on the Brooklyn (N. Y.) elevated railway last month indicates that electric operating possesses potential horrors that discount anything proceeding from the fire-bearing car heater.

On the Brooklyn Elevated Railroad there was a rear end collsion between two electrically operated trains, and the shock was sufficient to kill two persons, besides injuring many others. The cars were derailed, and the current from the third rail (the electric conductor) was short circuited in various places, and the current put into operation fires that acted like a number of electric welding apparatus. The cars were quickly a mass of flames. Had it not been that the fire department of the city of Brooklyn responded promptly to extinguish the burning cars, the accident might have resulted in frightful loss of life.

After the terrible accident which happened in the Park avenue tunnel in 1901 some of the advocates of electric operating insisted that there would have been little loss of life had the tunnel been electrically operated. At the time Mr. George Westinghouse publicly expressed the opinion that electricity might prove more disastrous than steam, operating under circumstances that would short circuit into wrecked cars the powerful electric current employed. This appears to have happened in the Brooklyn accident. If we remember correctly several inventions have been tried which prevented the electric conductors for railroads from being complete until breaks were closed by the contact shoe. The introduction of such an arrangement might be a very desirable safeguard against destructive accidents.

Our club agents would help us and assure the prompt delivery of the January number if they would send their list of names to this office by December 15. The last few weeks of the year bring such a rush of orders that our office force is overworked. Help them by sending in your list in good season.

October Number Exhausted.

Owing to an extraordinary demand for our October number the supply is exhausted, and it cannot be sent to subscribers or others. We regret that quite a number of applications for that number have had to be refused. We printed the usual number of copies, but for some unexplained reason there was a great run on that paper, a thing that happens occasionally to nearly all publishers. To one correspondent who writes, "Why don't you print another edition?" we answer that it would cost about $1,500.

On another page we print a paper by Paul Synnestvedt on the Nature of a Patent Right, which deserves the careful study of all persons in any way interested in patents. A widespread impression prevails that when the Government grants a patent to an inventor it is in some way bound to take the initiative in protecting the patentee's rights and that the granting of the patent is a guarantee that the invention is original and valuable. Mr. Synnestvedt's paper makes plain what the inventor obtains by securing a patent and the Government's duties toward him. Care is taken to grant patents only on new and valuable inventions, but the Patent Office authorities sometimes make mistakes about that and then it lies with the courts to decide on the rights of the inventor.

The Circuit Court for Wayne County, State of Michigan, issued an injunction on November 17 in favor of the Detroit Lubricator Co., and against the Michigan Lubricator Co., restraining them from using the words "Detroit Lubricators," "Improved Standard Lubricators," "Detroit Improved Standard Lubricators," in connection with their lubricators or advertising matter, also restraining them from using boxes or packages for their lubricators bearing the words "Detroit," or "Detroit. Mich.," unless their firm name be also given.

The J. A. Fay & Egan Company, Cincinnati, Ohio, have issued a little pamphlet, giving a list of second-hand machines in stock, and which come to them by way of exchange and which they sell at reduced prices. If you send for the catalogue or for a new or an old machine this company will be able to supply you on short notice.

The Falls Hollow Staybolt Company, of Cuyahoga Falls, Ohio, have recently increased the capacity of their works for the manufacture of double refined charcoal iron, hollow and solid staybolt material for use in locomotive, marine and stationary boilers. They have also built an addition 50x200 feet, which increases their storage capacity for raw material and for finished product.

"When your engine groans, it needs Dixon's Graphite. Give it a spoonful and see how much better it feels and works. A single dose may cure." Ask for booklet 69 C from the Joseph Dixon Crucible Company, Jersey City, N. J.

Tests of Hollow Stays.

The testing laboratories of McGill University of Montreal, Canada, have made some tensile tests of iron for the Falls Hollow Staybolt Company, of Cuyahoga Falls, Ohio.

There were three samples submitted to tensile test. Each 1 in. in diameter. The hollow stay yielded at 27,250 lbs. per sq. in., with ultimate strength 48,420 lbs., having 32.5% of elongation in 8 ins. and 53.7% reduction of area. The solid samples yielded at 33,790 lbs. per sq. in.; broke at 50,150 lbs. per sq. in., and gave an elongation in 8 ins. of 29.2% with reduction of area of 56.44%.

There were two samples of this company's product submitted to a vibration test made by the Grand Trunk Railway. Each specimen was 1 in. diameter. The Falls Hollow charcoal iron sample broke on 5,024 vibrations, which occupied 157 minutes. The other specimen, Falls solid charcoal iron, broke on 4,192 vibrations and lasted 131 minutes. Five samples of iron made by other manufacturers were tested, the best of them failed in 120 minutes with 3,840 vibrations. The testing strains were more severe than those encountered by staybolts in boilers and were purposely made so in order to ascertain relative merits.

Among the recent orders received by the Hicks Locomotive & Car Works, of Chicago, are the following: One 55-ton engine for the Butte City Railroad, a 4-wheel switching locomotive for the Hecla Belt Line, one 4-wheel switching engine for the International Harvester Company, and a 50-ton locomotive for General Construction Company, Davenport, Iowa. The firm has orders for passenger equipment, including: One coach for the West Virginia & Southern Railroad, a 57 ft. combination coach for the Green Bay & Western; also a private car for the Santa Fe Central, three passenger coaches for the Duluth, Missabe & Northern, one passenger coach and one combination car for the Duluth & Iron Range Railroad, and three coaches for the Louisiana Northwestern Railroad. The orders for freight car equipment include: Thirty gondolas for the Newton & Northwestern; fifteen tank cars for the Santa Fe Central, twelve flats for the Muncie, Hartford & Fort Wayne, and fourteen cars for the Ohio River & Columbus Railway.

The American Steam Gauge & Valve Manufacturing Company have again been compelled to seek new quarters, owing to the increase of their business, and are at present removing their entire plant and offices from Bismark street, Roxbury district, to the large brick buildings, 208-220 Camden street, Boston, Mass. The buildings have floor space of 85,000 square feet. The Mowry & Phillips foundry department will also be removed from South Boston, and every branch of the business will be consolidated at the Camden street factory. The new plant will afford them more than double the present capacity, and will be employed in producing their valves, gauges and indicators; also special metals and foundry work in the Mowry & Phillips department.

The American Locomotive Sander Company, of Philadelphia, Pa., have recently issued an illustrated catalogue, which tells all about locomotive sanders. The catalogue contains some remarkably clear half-tones which show the sander in section and in elevation and adapted for single drivers, double, treble and quadruple, as the case may be. The various parts are shown in detail, and the action of the apparatus is set forth in the letterpress. This company are the owners and sole manufacturers of the "She," sanders, the Leach, the Sherburne, the Houston, the Dean, the Curtis and the Austin sanders. Write for a catalogue to Thirteenth and Willow streets, Philadelphia, if you are interested in sanders.

The Smooth-On Company, of Jersey City, have recently received a testimonial from Mr. George E. David, engineer and machinist for the Bureau of Fisheries, at Wood's Hole, Mass. Mr. Davis writes that he repaired a leaky boiler of the Scotch type by the use of the Smooth-On compound, which he had purchased from the Walworth Manufacturing Company, of Boston. The leaks which he stopped were around the ends of the furnaces. In applying the compound he cleaned the surface of the iron inside and washed it thoroughly with gasoline, then painted on a coat of Smooth-On, and let it stand twelve hours. He then mixed a thick putty of the compound and pressed it well into the joint, and let it stand twenty-four hours. The boiler has been tight ever since. The compound is also used for making pipe joints. Write the Smooth-On Company, 572 Communipaw avenue, Jersey City, if you desire further particulars.

We understand that the Southern Pacific people are largely reducing the force in their different repair shops. This seems to be rather curious, for from all accounts the business of the Southern Pacific system has been very active during the past year and business cannot be conducted without rolling stock being worn out.

The bound volumes of RAILWAY AND LOCOMOTIVE ENGINEERING for the year 1903 will be ready about Dec. 10. As only a limited number will be for sale it is necessary that intending purchasers place their orders with us as soon as possible. The volumes are $3.00 each.

A Rubber-Tired Car Wheel.

Anything that will abate the horrible noise made by the wheels of elevated railroad cars will be a blessing and a comfort to the myriads of persons whose nerves are racked by the overhead tumult constantly assailing their ears from the overhead structures. We have frequently reflected about the evil and tried mentally to devise a remedy, but nothing seemed practicable as long as steel tires were permitted to roll upon steel rails. We now believe that an inventor has perfected a wheel which will prove an effective remedy and enable elevated trains to be operated without objectionable noise.

Major R. P. Tomassek, a military and civil engineer of mature experience in the construction and operating of street car tires, has been for years devoting himself to the inventing of a noiseless car wheel, and we believe that he has now succeeded in improving a wheel which will meet all the requirements of train or street car service. Vulcanized solid rubber tires have seemed practicable for car wheels since their durability was demonstrated under heavy trucks, but no satisfactory means of fastening them was devised until Major Tomassek undertook to work out the problem. He has now produced a fastening which promises to meet all the requirements of keeping the elastic material in place and in shape.

This is done by means of an annular T-shaped rim supplied with rows of openings which are embedded in the elastic composition and the tire is forced into the bed between the rim and the wheel flange under enormous hydraulic pressure. The tire and fastenings are held in position by bolts passing through the rim and the wheel center. The tire used in the wheels we examined has 3¾ inches face and is 4 inches deep, which, with the strong fastenings, forms a mass that will readily resist all the shocks likely to be put upon it by hard train service. It presents a generous tread that will put as wide a bearing on the rail as the ordinary steel tired wheel does.

The wheel is known as the "Sampers Wheel," and is the invention of Isidore H. Sampers, of New York City. It is ingeniously constructed to bring the center of the elastic tire to the center of the rail-head and to provide for an equal distribution of the cushion property of the tire. It is also supplied with a twenty-inch drum cast on the spokes and intended to receive a steel band for breaking purposes.

Completed the wheel weighs nearly three hundred pounds, about the same weight as the present cast-iron wheel now in use.

We believe the wheel is destined to have a great future. The prevention of noise is what will recommend this form of wheel to the public, but users will find it a valuable preventative of the shocks which wear out rolling stock prematurely and grind steel rails into dust in a few years. Steel springs provide cars with comfortable resilience, but when they are carried on rubber tires they ought to roll as smoothly as a ship glides through the water.

It may require pressure to induce railroad companies to adopt this wheel, but we feel certain that once they adopt the improvement they will find it the best investment they have ever made.

The Walworth Manufacturing Company, of Boston, Mass., have just issued an illustrated catalogue of the new Walworth locomotive injector which they have just put on the market. The Walworth people recently purchased the right to manufacture what has hitherto been called the "Mack Injector," but which will henceforth be known as the Improved Walworth injector. The types made for locomotives are the "National," the "NT," "A" and "E." This latter is a very compact upright non-lifting injector, the others are horizontally placed "lifters." Each kind is catalogued and illustrated, with sizes, capacity and price. The company also list to a Walworth stationary non-lifting and a Walworth stationary lifting injector. The Dodge automatic injector is also made by this firm. The company, whose general offices are at 132 Federal street, Boston, Mass., will be happy to forward a copy of their locomotive injector catalogue to any person who is interested enough to apply to them for one.

The second edition of Catalogue No. 115, the condensed general catalogue of the B. F. Sturtevant Co., Jamaica Plain, Mass., has gone to press and will very soon be ready for distribution. A few pages in this revised edition have been devoted to Factory and Industrial Railway Equipments, a new departure of this enterprising concern.. The outgrowth of the success attained in equipping their new plant at Hyde Park, Mass., was the manufacture of this new line of products.

The most common measure of work is the foot-pound which means the raising of one pound one foot high. Where the metric system of weights and measures are in use the unit of work is raising one kilogram one meter. That is equal about to 7.24 foot pounds.

Grinding off brake shoe metal through brake rigging being geared up too tight is an expensive operation. When a train pulls unusually hard it is a good thing to note how many brakes are only half released.

Locomotive Works Her Passage on the Ohio.

The story is told of the firm of Smith & Porter, which later became the well known H. K. Porter Company. The original firm in 1868 built a locomotive for a small railroad running out of Greenup, Ky. This town is 333 miles below Pittsburgh, Pa., on the Ohio River, and at about the time the delivery was to be made none of the towboats appear to have been available, the river being very low owing to a long drought, and other transportation facilities were not to be had. It was, however, decided by Smith & Porter that the engine should be delivered at the specified time. Mr. Smith obtained a suitable flat boat, and placed the machine aboard, and with the help of several men the locomotive was arranged to propel the boat.

The main driving wheels were at the rear, and the side-rod extended forward, as in many of our modern 4-4-2 engines. The front ends of the side-rods were uncoupled and the rods thrown back so that they extended out behind the engine as far as the leading wheels were ahead of the main drivers. The projecting ends of the side-rods were coupled to a temporary crank shaft, arranged for the purpose, and on the ends of this shaft were two paddle-wheels. The main drviers were jacked clear of the rail and the boiler was fired up.

When steam was turned on by Engineer James M. Schooley, the locomotive presented a strange appearance, standing on the deck of a scow, its leading drivers hanging motionless, its main driver slowly turning and its reversed side-rods working a crank shaft which made a pair of dripping paddles revolve, while the engine solemnly puffed its way down stream. We do not know if any conversation was permitted with the man at the wheel, but this novel locomotive-steamboat made the voyage successfully, and furnishes a good example of what men of enterprise could do to overcome difficulties thirty-five years ago.

Blows in Two-Cylinder Compound Locomotives. Schenectady and Rhode Island Systems.

Blows in two cylinder compound engines are developed through wear of packing rings in intercepting valve and separate exhaust valve, and in rings of piston valve and cylinder packing. To determine if intercepting valve is blowing, place right hand crank on upper quarter, and reverse lever in center of sector, bringing main valve central over its ports. Intercepting valve to be closed and separate exhaust valve open, as when starting simple; if intercepting valve blows, steam will pass through separate exhaust valve and appear at exhaust nozzle. See Fig. 3, Schenectady

compound pamphlet. There is no way to visibly detect a blow in the Rhode Island intercepting valve. If such a blow exists the steam passes to the low pressure steam chest, whether working simple or compound.

To test piston valve, place crank on upper quarter on side tested, and reverse lever in center of sector. The valve being on center of its seat and covering both steam ports, will show steam at one or both cylinder cocks if rings are blowing. This test applies to valves of either outside or inside admission. To test cylinder packing rings, leave crank on upper quarter, and place reverse lever in full forward or back gear, opening either steam port full. If packing rings blow, steam will appear at cylinder cocks. If piston valve packing blows on high pressure side, the effect is to let steam through the exhaust port into the receiver, and also to the opposite side of piston. If cylinder packing of high pressure piston blows, the effect is to let steam pass to the opposite side of piston and out through exhaust port into receiver. Blows in piston valve rings or cylinder packing rings have no effect on the operation of by-pass valves for the reason that steam chest pressure is always greater than the wire drawn pressure due to blows.

The separate exhaust valve remains stationary when running, except as actuated by pressure on its piston to open, or tension on its spring to close. If spring in separate exhaust valve is weak, the result will be closed by receiver pressure. This action applies to the Schenectady compound. The separate exhaust valve of the Rhode Island compound, in case the spring is too weak to close the separate exhaust port, will be forced open by the receiver pressure when working compound, diverting the exhaust from low pressure steam chest to exhaust pipe and engine will work simple.

A drummer who recently returned from a trip through Texas remarked that the trains on some roads were so late that the railroad men sometimes forgot they had started.

In a scientific magazine published as long ago as 1885 we find a description of a dirigible balloon which was said to move against a light wind. Balloon makers have not made conspicuous progress since that time.

We believe in the maxim that, for all right judgment of any man or thing it is essential to see his good qualities before pronouncing on his bad ones.

Reading maketh a full man, conference a ready man, and writing an exact man.—*Bacon.*

CONTENTS.

In France there are 15,319 women employed as gatekeepers at the railway crossings. They get very small pay, but are provided with houses, fuel and light.

It is true that the world owes everybody a living, but she must be reimbursed by hustling. The sweat of your brow or brain is the current coin that must be paid.

INDEX TO ADVERTISEMENTS.